FEB 13 1958 B 695145

CONSTRUCTION • OPERATIONS • MAINTENANCE

PIPE LINE INDUSTRY

FEBRUARY 1958

ONE COPY SENT TO

THE LIBRARY OF CONGRESS SERIAL RECORD

FEB 27 1958

MAINTENANCE SLEUTH

Radioactive Tracers Gage Bearing Wear 36

ACCURATE MEASUREMENT

Design Runs to Reduce Pulsation Effects 41

BETTER ENGINEERING

Couplings Control Axial Thrust on Pump 45

SAFER OPERATIONS

Quick Control of Gas Fires is Possible 54

EASE R-O-W PROBLEMS

Rubber-Tired Spread Lays 6-Inch Fast 57

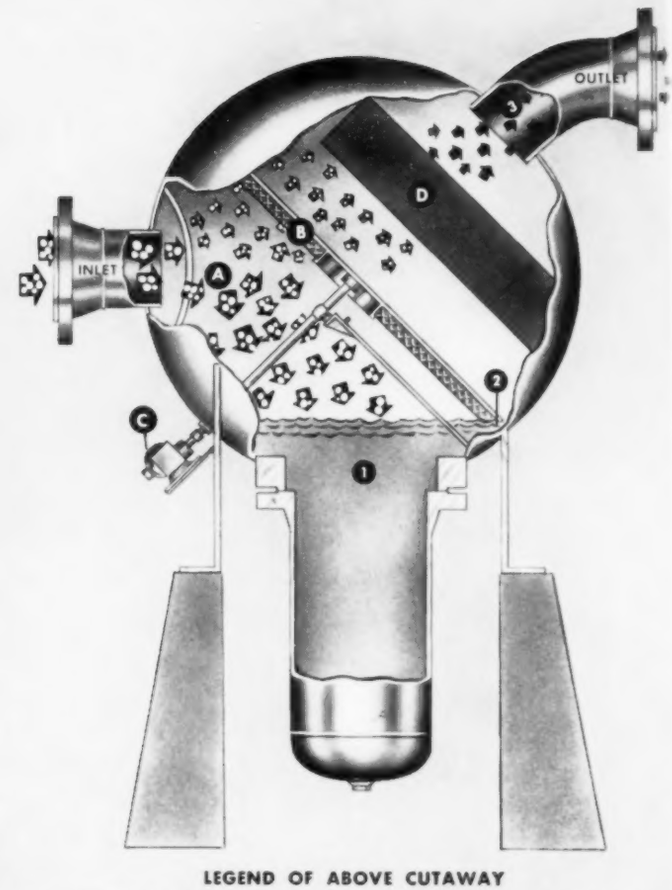
GUIDE FOR LEARNING

Streamline Your Employe Training Plans 64

For a "Quick Look" at this issue, turn the page . . .

SUBSCRIPTION PRICE $2 PER YEAR • SINGLE COPY PRICE FIFTY CENTS

OPERATION PROVES
It's Cleaner Gas with
PEERLESS
SCRUBOSPHERES



LEGEND OF ABOVE CUTAWAY

The majority of incoming liquid (A) and solid particles are directed to either side and down into reservoir (1). Lighter solid particles carried by gas stream are separated on surfaces of contactor (B) which are kept wet and clean by revolving thru liquid reservoir (2). Contactor is revolved by explosion-proof gear motor (C). Mist Extractor (D) removes any remaining liquid particles from gas stream prior to outlet (3).

Operation of these four-66" I.D. Scrubospheres has demonstrated their superiority over conventional oil bath dust scrubbers. The dust removal ability of the SCRUBOSPHERE is outstanding because it utilizes wetted surfaces for dust collection which are more closely spaced than in conventional equipment.

Operation of these Peerless units has also proven their superiority with respect to minimum oil loss because oil is periodically removed from the Scrubospheres whereas **it must be periodically added to other scrubbers** in the same plant operating under comparable conditions. Pat. applied for

Let your Peerless Representative give you full details.

PEERLESS MANUFACTURING COMPANY

Walnut Hill Lane at Old Denton Road
P. O. BOX 13165 • DALLAS, TEXAS
Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

FEB 13 1958 B 695145

PIPE LINE INDUSTRY

CONTENTS and Quick Look

February, 1958 Vol. 8, No. 2

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

Radioactive Tracers Used to Measure Bearing Wear

☐ Tests conducted on irradiated bearings have shown that relative connecting rod bearing wear at different operating conditions can be predicted by using the load carrying capacity concept. Here's an explanation of how these tests were conducted and other interesting revelations.

By M. W. Savage and L. O. Bowman.....Page 36

Pulsations and Gas Measurement

☐ Proper design of meter runs is necessary to minimize the effect of pulsations in the gas pressure. These pulsations can cause an error in the meter reading. The AGA is sponsoring research to study the effect of gas pressure pulsations.....Page 41

Limited End Float Couplings

☐ In some instances, motor bearing damage may result from axial forces transmitted by the coupling back from the pump or compressor. A thrust bearing in the driven machine plus a limited end float coupling prevents this axial thrust from being transmitted to the motor shaft.

By E. B. Mills and John E. Petermann.....Page 45

Economical Operation of Glycol Dehydration Units

☐ Factors which must be considered in selecting and operating glycol dehydration units are discussed. Methods for determining the most economical and efficient system are given.

By Warren Richardson.....Page 49

Control of Natural Gas Fires

☐ A series of tests has determined the effectiveness of dry chemicals in the control of various types of natural gas fires. The relationship between the rate of gas flow and the rate of dry chemical flow was established. Type of clothing required by fire fighters for various types of fire was also determined.

By Arthur B. Guise.....Page 54

Rubber-Tired Boomer Speeds 6-inch Job

☐ Use of a sideboom equipped farm tractor cuts cost of laying small gathering line job for Okan Pipeline Company. Right-of-way clean-up was reduced to a minimum. Mobility and versatility are big advantages of the novel pipelayers.

By Ernest A. Slade.....Page 57

Graphs Simplify Design of Pads

☐ Here is a set of charts that will do away with time-consuming trial and error calculations in the design of pads for station scrubbers, stacks and vertical vessels. Make use of this engineering aid to get economical solutions quickly.

By John B. Grant and Raymond J. Smith..Page 59

Streamline Your Training Course

☐ Psychological studies show that concentration on five specific areas can markedly improve any training program. Here is a complete report on these training "boosters," plus a helpful chart of "do's" and "don'ts" for training instructors.

By Carl Mullins White.....Page 64

REGULAR MONTHLY DEPARTMENTS

Editorial Page	4
Pipe Line Panorama	35
Rules of Thumb	62
If Oil Could Speak	66
Construction News	67
Pipe Line Hints	76
Pipe Line Men in the News	82
Who's Meeting Where	88
What's Happening Among Service and Supply Men	89
What's New in Equipment	93
New Equipment Catalogs and Literature	103
ADVERTISER'S INDEX	106

PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

Let's answer the critics

"Of all the tax avoidance gimmicks, percentage depletion provides the biggest windfalls."

The above statement appeared last month under a three-column headline in one of the nation's largest newspapers. Millions of people, oil industry employes included, read the one-sided bombardment against oil's depletion provision.

Opinions were formed—*against* the oil industry.

Throughout 1957 the nation's most widely read union publications kept up a relentless attack against "big, profiteering" oil companies. Some of the anti-oil cartoons that appeared would turn a businessman's stomach. Millions of union members, oil industry employes included, saw this vicious attack against oil.

Opinions were formed—*against* the oil industry.

In recent months, oil industry critics in top government circles have pulled out all stops in their criticisms of the oil industry. The news reports of these attacks—natural gas, oil prices, anti-trust, S-11, depletion, Elkins Act—were read by millions of people, oil industry employes included.

Opinions were formed—*against* the oil industry.

•

Who is to blame for a situation which allows the press, unions and government officials to verbally rip apart one of the nation's most vital industries? None of these groups intentionally attack issues the public understands and is in favor of—not when subscribers, members or votes hang in the balance.

This leaves only one possible answer. Through the mistaken belief that "being responsible" is the only factor needed to win the good will of the public—through its resulting failure to fight fire with fire, the oil industry has allowed its critics to create a public opinion climate that is receptive to unwarranted attacks against oil operations in general.

•

The situation can be corrected, although much damage has resulted from this ultra-conservative attitude. And the best place to start is right in our own house—among the industry's 1,650,000 employes and several hundred thousand stockholders.

In support of this statement, a recent survey showed that:

- Three out of every four Americans learn about the oil industry from personal contacts with people in it.
- Through service station personnel alone, the oil industry has face-to-face contacts with each of the 65 million American motorists at least 73 times a year.
- The average oil industry employe talks to 16 persons a week—nearly 20 million opportunities to put in a good word for oil to friends and neighbors each week!

These groups haven't been completely neglected by the oil industry. Far from it. The Oil Information Committee has prepared excellent material for employes and the public. And some companies have used it—but not enough.

Reaction to two recent WORLD OIL booklets prepared to inform industry and non-industry people about oil's side of important issues clearly indicates the oil industry is taking steps in the right direction. More than 100 companies and oil associations ordered nearly 250,000 copies of the eight-page "Facts You Should Know About Oil Prices" which appeared in WORLD OIL last March. Nearly 75,000 copies of last November's "What You Should Know About Federal Control of Natural Gas" have been distributed.

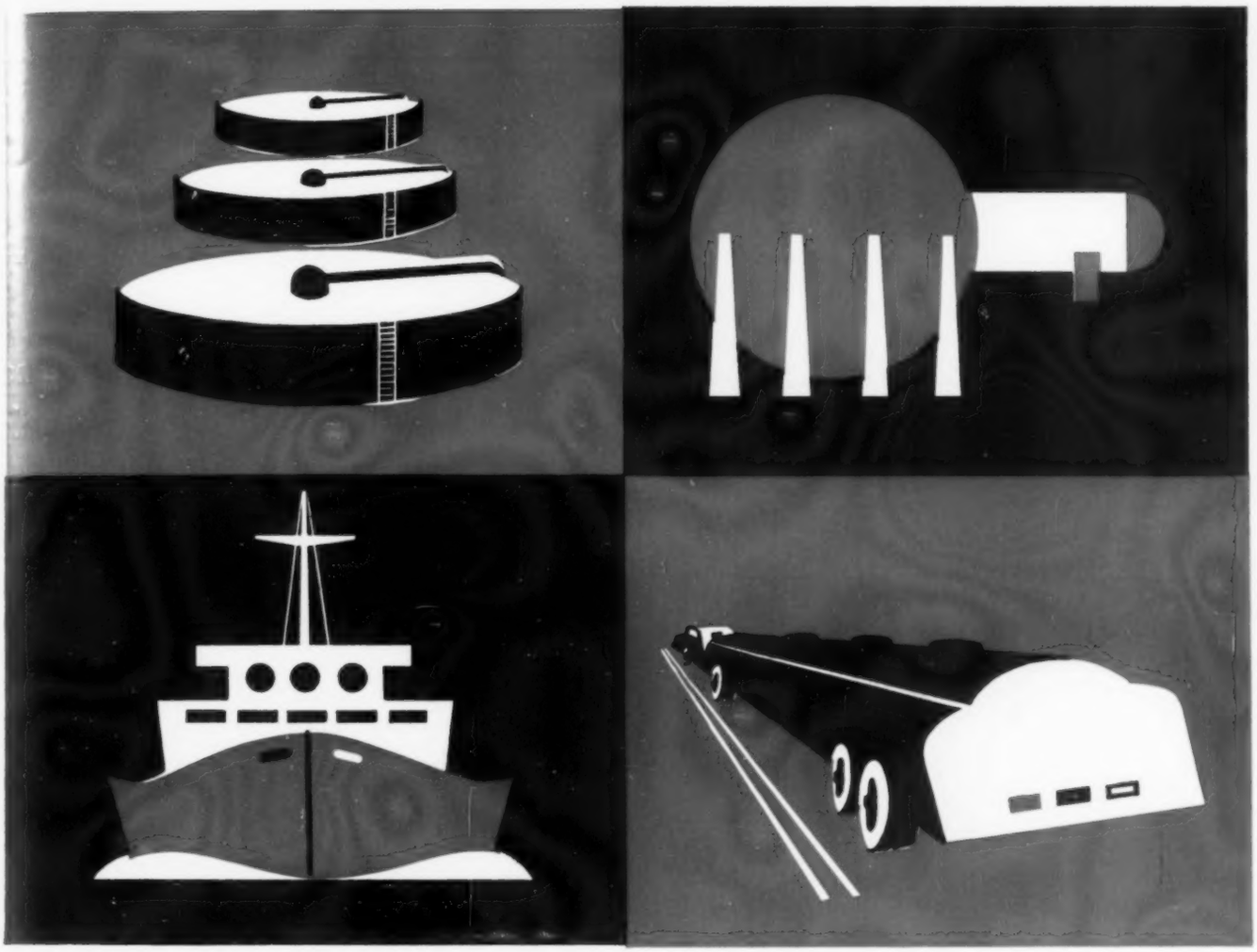
However, even this show of interest is but a drop in the bucket.

•

To be successful in changing some of the negative and erroneous opinions that have already been formed, the effort must be industry-wide and company-wide. The story presented must be factual and fair.

Oil's critics make effective use of the printed word to criticize and belittle the industry in the eyes of employes and the public. It is high time the oil companies used the same medium to tell the same people oil's side of the story.

In a few brief words, let's start forming opinions too—*for* the oil industry.



World's most complete line of Storage Tank Fittings

Only Shand and Jurs offers world-wide availability and service on mechanical fittings — vents, gages and valves — for storage tanks. Stocks are maintained in key cities for prompt delivery to your tank farm, yard or depot.

Proved by over 36 years service, S&J tank fittings have set the industry standard for economy, safety, accuracy and dependability. Call or write your nearest S&J office for catalog and prices on the type of fittings you need.

S&J is also a world-leader in the manufacture of electrical remote supervisory control equipment.

SHAND AND JURS

GENERAL PRECISION EQUIPMENT CORPORATION — GPE

2600 Eighth Street, Berkeley, California
Branch offices and representatives in principal cities

PIPELINER WINS THE BATTLE OF THE MOJAVE DESERT

Unexpected rock. High winds. Rivers. Mountains. Sand. R. H. Fulton overcame them all with the help of its Caterpillar spread.

NEW CATERPILLAR NO. 572 PIPELAYER, left, teams up with No. 583 and the MDW8, lowering in on the Mojave Desert. The new No. 572 has a capacity of 86,000 pounds with a 19-inch ground clearance and 86-inch track gauge to give stability.

D9 WITH KELLY RIPPER (left) prerips unexpected rocky soil for ditcher. The Cleveland Ditcher (right) which follows is powered by a dependable Cat D339 Engine. The ditcher is cutting a depth of 65 inches at about 28 feet per minute.

NATURE put R. H. Fulton & Co. to the test during a 241-mile natural gas pipeline job across the Mojave Desert from Needles to Newhall, Calif.

Rock cropped up unexpectedly. Unseasonable high winds held up welding and painting, at times backfilled the ditch. Sand made maintenance of a firm ditch difficult. There were three river crossings and rugged mountainous terrain. But Fulton, with the help of its big Caterpillar spreads, overcame each obstacle, lowering in an average of 5,000 to 6,000 feet a day with a one-day high of 16,000 feet.

The 30-inch line is part of a $33.5 million joint expansion program of Southern California and Southern Counties Gas Companies. It will provide an additional 227.6 million cubic feet of gas per day.

Here are some of the problems Fulton encountered and how they were overcome:

ROCK—This occurred in stretches of presumably sandy material from 9 to 24 inches below the surface. By using huge Kelly Rippers mounted on the giants of the spread—CAT* D9 Tractors—a great deal of shooting was eliminated. The D9-Kelly Ripper combination prerippped the rocky soil for the ditcher.

Because of danger of rock damage to pipe in backfilling, the entire length is padded on the bottom of the ditch and top of the pipe. Two Cat No. 977 Traxcavators* and a Crosse Ditch Padder side-mounted on a D8 were used for the padding operation. A D7, working with a No. 12 Motor Grader, backfilled.

WIND—Unseasonable high winds backfilled the ditch and periodically stopped welding and painting operation. But welding crews set a brisk pace in spite of the winds. Using Caterpillar* Twin Arc-Welders on Athey track wagons pulled by a D7, their best day was 16,200 feet.

MOUNTAINOUS TERRAIN—Rugged Kane Springs Canyon and the Ord Mountains had to be crossed. A D8 and D9 were used to winch a Northwest Backhoe over the steep canyon grade. Later, D9s towed stringing trucks in and out of the mountainous area.

Altogether, Fulton had almost 70 Caterpillar track-type Tractors and Pipelayers at work. In addition there were five Twin Arc-Welders, and dependable Caterpillar Diesel Engines powered cranes, backhoes and ditchers.

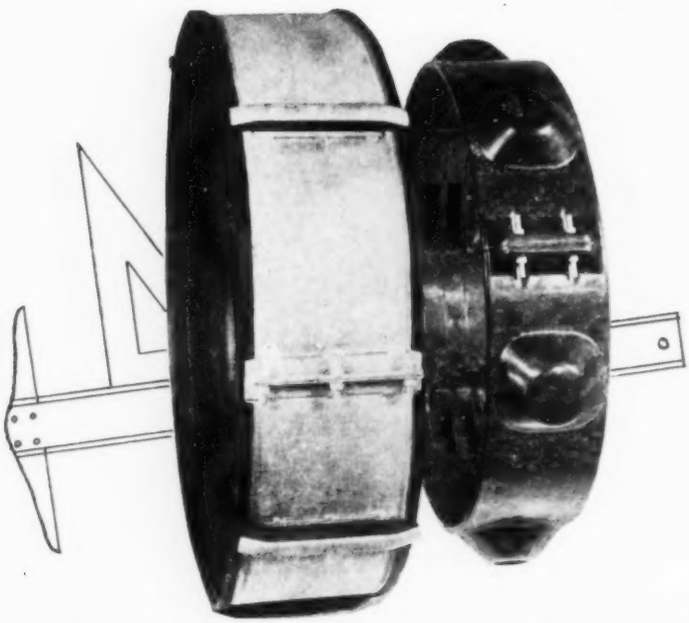
When it comes to the tough jobs, pipeliners know there is only one make of equipment designed to produce wherever the pipe takes them. That's why the standard color in fast-moving spreads throughout the world is Caterpillar yellow.

CAT TWIN ARC-WELDERS, mounted on Athey track wagons and pulled by a D7, helped make up for time lost due to high winds in the desert. Best day: 16,200 feet.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS, U. S. A.

*Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

"Something From The Irishman"



TO EXCEED YOUR SPECIFICATIONS

CROSSING INSULATORS

A **Complete Line** of **Crossing Insulators, Rugged** and **Easily Installed, Maloney** Models 55, 56, and 57 encompass **All Applications. Neoprene** and **Metal** or **Molded Fiber Glass** reinforced polyester resin. **Competitively Priced,** there is a **Maloney Insulator** for **Your Specifications.**

CASING SEALS

Whether **New** or **Replacement** service is **Specified,** a **Maloney Casing Seal** will **Fill** those **Specifications** with an **Ample Margin. Slip-on** and **Zipper** types of **Tough Maloney-Compounded Neoprene** will fit a **Wide Variety of Adverse Installation Conditions.**

MANUFACTURED BY

F. H. Maloney COMPANY

HOUSTON • TULSA • LOS ANGELES • PITTSBURGH

OR YOUR *Maloney* DISTRIBUTOR

PIPE LINE INDUSTRY

RAY L. DUDLEY, Founder, 1891-1957

WILLIAM G. DUDLEY.....Publisher
TOM W. NELSON.....General Manager
R. M. DE SOMBRE.....Assistant General Manager
WARREN L. BAKER.....Editorial Director
MELVIN A. JUDAH.....Editor
JOHN C. WATTS.....Engineering Editor
WALLACE FITZGERALD.....Managing Editor
CECIL W. SMITH.....Associate Editor
DON E. LAMBERT.....Associate Editor
JACK COCKERHAM.....Presentation Editor
GILBERT M. WILSON.....Western Editor
ANTHONY GIBBON.....Mid-Continent Editor
H. T. BRUNDAGE.....Eastern Editor
DONALD G. DEPUGH.....Editorial Assistant
MARGARET MCKENZIE.....Editorial Assistant
KATHERYNE BAST.....Editorial Assistant
EUNICE OKONESKI.....Librarian

ADVERTISING

Nelson Bigelow, Advertising Sales Manager. *Representatives:* NEW YORK (17): Sam Sorrell, Gene Hart, George Skelton, 250 Park Ave., Phone YUkon 6-6558; CLEVELAND (15): Bill Westfall, Harvey Dunn, 1010 Euclid Ave., Phone MAin 1-3295; CHICAGO (4): H. G. Fitzpatrick, Martin Halloran, 332 So. Michigan Ave., Phone Wabash 2-9330; LOS ANGELES: Jay Curts, W. W. Wilson Bldg., Huntington Park, Phone Ludlow 7-1219; TULSA (3): Jim Isaacks, 916 Enterprise Bldg., Phone CHerry 2-9211; DALLAS (8): Ed Thompson, 1808 Sylvan Drive, Phone RIverside 7-7244; HOUSTON (19): Charles Wyatt, James W. Merrill, 3301 Buffalo Drive, Phone JAckson 9-4301; EUROPEAN: Theodor Miocha, Agent, Limmerstrasse 31, Hannover, Germany, Phone 4-2935; UNITED KINGDOM: Frank Chambers, Agent, 120 Moorgate, London E.C. 2, Phone Monarch 5661. Advertising rates on application.

•

SUBSCRIPTIONS

T. A. Gaden, Subscription Manager, P. O. Box 2608, Houston 1, Texas, U. S. A.

Single copies 50 cents (except special issues).

Double price for single copies more than a year old. Subscription price: domestic and foreign $2 a year; 2 years, $3; 3 years, $4. Subscription restricted to those engaged in the pipe line branch of the oil and gas industry, or the manufacturing and distribution of pipe line equipment.

Specialized oil publications of THE GULF PUBLISHING COMPANY, 3301 Buffalo Drive, Houston 19, Texas; Box 2608, Houston 1, Texas. Cable Address: GULFPUBCO.

PIPE LINE INDUSTRY and the PIPE LINE COMPOSITE CATALOG for the oil and gas pipe line industry.

WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing-pipe line industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

Copyright, 1958, by The Gulf Publishing Company

Indexed by Engineering Index and Industrial Arts Index

Flexitallic® — Industry's Spiral-Wound Seal Since 1912

NOW IDENTIFIED FOR ENGINEERS

Flexitallic Blue is a positive means of gasket identification.

The blue dye in the Canadian asbestos filler tells an engineer that this is a genuine Flexitallic Spiral-Wound Gasket, made to just one standard of quality since 1912.

Flexitallic Gaskets are exclusively spiral-wound. Constructed to meet specific conditions of thermal and mechanical shock, vibration, weaving and other joint stresses.

The high safety factor of Flexitallic Gaskets results from two unique characteristics — compression response of the gasket is directly related to bolting for each application; exacting mechanical controls assure that manufactured gaskets conform to specification.

Whenever you are confining fluids in a critical pressure/temperature range, insist on Flexitallic Spiral-Wound Gaskets. Look for Flexitallic Blue.

FLEXITALLIC GASKET CO.
8th & Bailey Sts., Camden 2, N.J.
Representatives in principal cities

Flexitallic®
SPIRAL-WOUND GASKETS

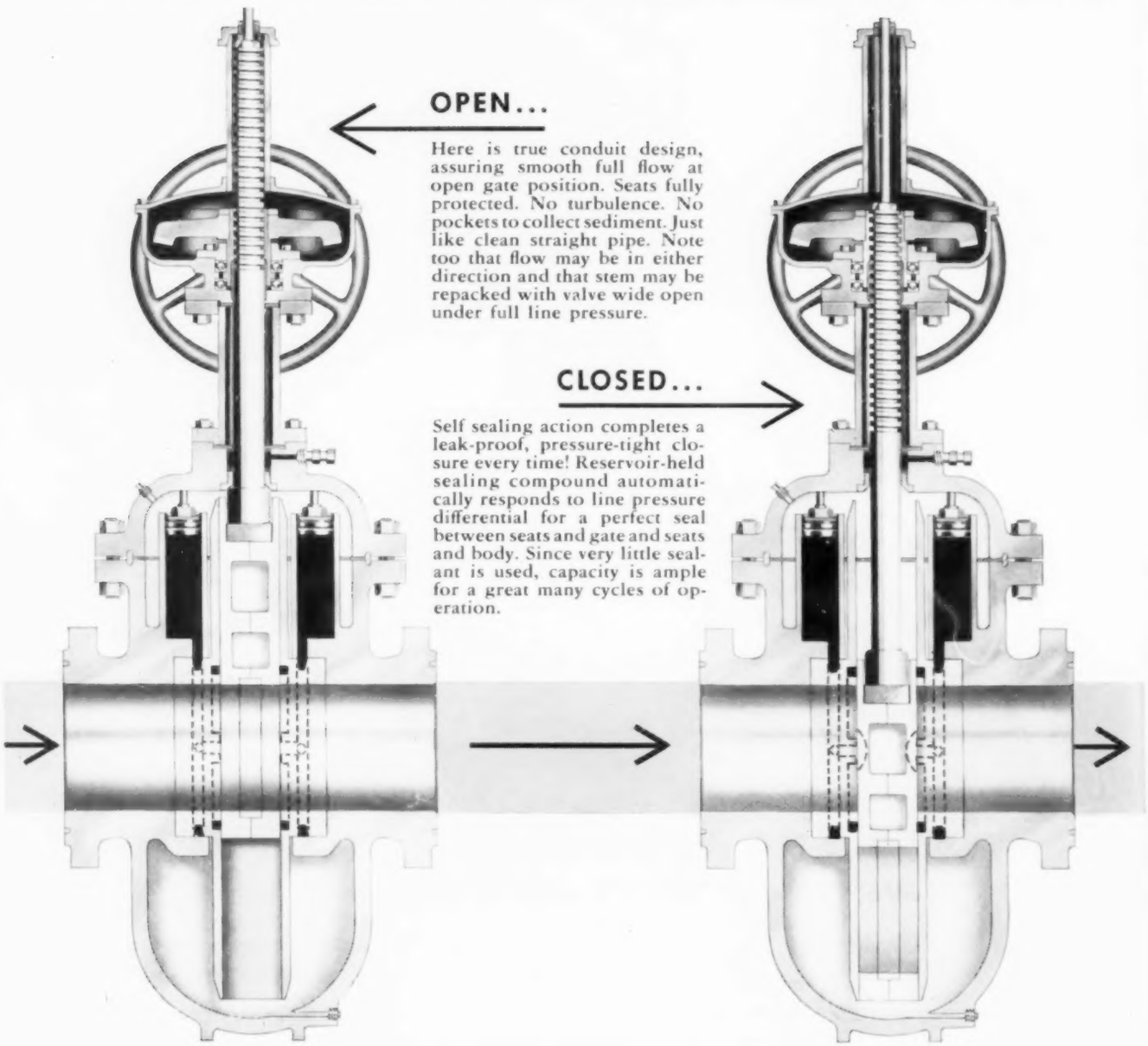
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

® Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

For more data on advertised products, use Readers' Service Cards, last page.

It's an "Open and Shut" case for...

DARLING-McEVOY CONDUIT GATE VALVES



OPEN...

Here is true conduit design, assuring smooth full flow at open gate position. Seats fully protected. No turbulence. No pockets to collect sediment. Just like clean straight pipe. Note too that flow may be in either direction and that stem may be repacked with valve wide open under full line pressure.

CLOSED...

Self sealing action completes a leak-proof, pressure-tight closure every time! Reservoir-held sealing compound automatically responds to line pressure differential for a perfect seal between seats and gate and seats and body. Since very little sealant is used, capacity is ample for a great many cycles of operation.

THESE and other features combine to make Darling-McEvoy conduit gate valves unique and unmatched in pipe line service today. They are now available in 4" and larger sizes, fully field proved, with experience a matter of record on various major lines. For detailed information ask for Bulletin 5402.

AUTHORIZED DARLING DISTRIBUTOR

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 27, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

HOW KONTOL REMOVED 16 TONS OF SCALE FROM A PIG-CLEANED PIPELINE

This eastern pipeline—a 385 mile 6" product line—had never been cleaned before. When a cleaning program was finally decided upon, scrapers were used. Numerous scrapers, both brush and knife, were run through sections of the line. For example, 73 sets were run between Pump Stations No. 1 and 2, 40 were run between No. 2 and 3.

After a 5-month scraper program, the line efficiency (as expressed by the "C" factor) increased from 123 to 133—after which it remained constant, despite the use of additional scrapers. When a scraper was used, however, the stream continued to go off-color about 15 minutes before the scraper arrived at the pumping station.

Then Kontol corrosion inhibitor was applied at the rate of one gallon per thousand barrels of throughput. One day later, two scrapers were run through the line. At the scraper trap the stream went off-color thirty minutes before the arrival of the first scraper, and stayed off-color until after the arrival of the second scraper. A second set of scrapers was run 12 days later, with similar results — *definite evidence that Kontol loosened scale previously untouched by the scrapers.*

RESULTS OF KONTOL TREATMENT

Line throughput increased 720 bbls./day.
An estimated 16 tons of scale removed.
Further rusting and scaling arrested.
The need for scraping eliminated.

KPL-58-1

SUMMARY OF "C" FACTOR BEFORE AND AFTER KONTOL
(following use of scrapers)

LINE TREATED	Before KONTOL	After KONTOL
Pump Station No. 2 to 3.....	132	138
Pump Station No. 3 to 4.....	135	142
Pump Station No. 4 to 5.....	138	145
Pump Station No. 8 to 9.....	118	135

KONTOL

Write for this **FREE KONTOL BULLETIN**

KONTOL 77

TRETOLITE COMPANY
DIVISIONS OF PETROLITE CORPORATION
369 Marshall Avenue, Saint Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California
Chemicals and Services for the Petroleum Industry
DEMULSIFICATION • DESALTING • CORROSION INHIBITING • PARAFFIN REMOVAL • SCALE PREVENTION
WATER DE-OILING • INJECTIVITY STIMULATION

Look to COOK for Better Packings!

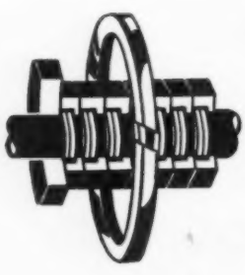
Don't Let This Happen To Your Packing Glands!

NO doubt about it — using the wrong material for a packing gland in corrosive service is like locking a wildcat in a cardboard box. It will be chewed up in no time!

There's no need for rust and corrosion to raise havoc with your packing glands, regardless of how tough the service. In 999 cases out of 1000, packing glands made of Cook stainless steel or Cook *Ni-Resist* type iron will solve your problem, once and for all.

For the remaining 1 problem in 1000, Cook can probably *design* an answer. That's because C. Lee Cook pioneered in the field of metallic packings — knows more about their specific, on-the-job applications than anyone else.

Whether you manufacture original equipment or want to recondition old packing cases, always insist on genuine C. Lee Cook parts and service. Write for full details. C. Lee Cook Company, 944 South 8th Street, Louisville 3, Kentucky.



C. LEE COOK COMPANY

Division of Dover Corporation

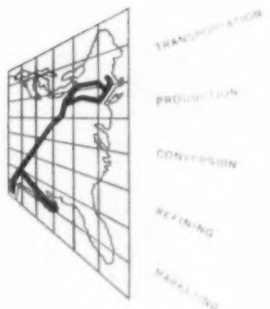
Rings and Packings Since 1888

FROM THE GROUND UP...

From gas well to distant city ... from wildcat test
to service station driveway ... Tennessee Gas Transmission Company
is active in every aspect of oil and gas.

Our name tells you we transport natural gas ... about two billion
cubic feet daily, in fact, through 10,000 miles of pipeline in 15 states.
Today we also explore for and produce oil and gas from
South America to Canada ... extract and convert natural gas hydrocarbons
... **refine, transport, and** market a full range of petroleum products.

Like the industry itself, we are broadening our activities ...
for ever-wider service to America.



TENNESSEE GAS TRANSMISSION COMPANY
AMERICA'S LEADING TRANSPORTER OF NATURAL GAS
HOUSTON, TEXAS

ELLIOTT 2-POLE MOTORS

tailored to pipe line service

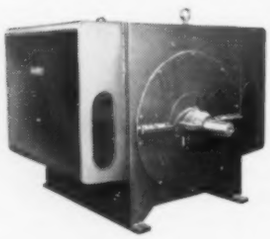
The versatility of ELLIOTT motors solves pipe line pumping problems

More than 40 years ago, Elliott built the *first* large 2-pole induction motor. Since that time, the company has engineered more significant design improvements . . . and sold far more large 2-pole machines, than anyone else. The largest 2-pole induction motors yet built (6000 hp) were designed and built by Elliott.

This engineering background stands behind the Elliott motors described here . . . motors designed especially for *pipe line service*.

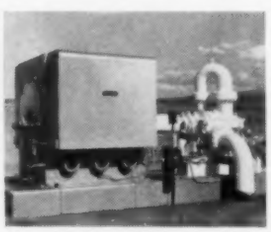
WEATHER-PROTECTED DESIGNS FOR PUMPING STATIONS

- for outdoor locations



Especially designed for outdoor service—not a modified indoor motor. Permits wind-driven rain and snow to blow straight through inlet openings. No housing or enclosure is necessary. Water and dirt positively prevented from reaching motor interior.

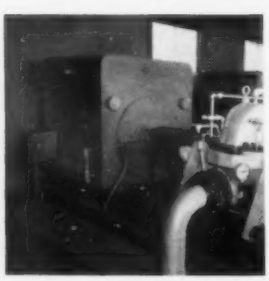
- for isolated locations



Where cooling water is unavailable or in short supply, an integrally-lubricated adaptation of the famous Elliott "weather-protected" motor is recommended. The recirculated lubricant is cooled by passage through finned-tube coolers.

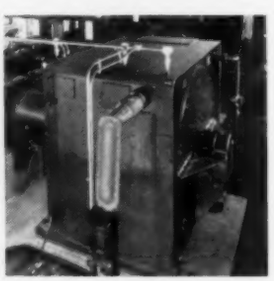
SPECIAL MOTOR ENCLOSURES FOR COMPRESSOR STATIONS

- externally-ventilated



Heavily-encased, completely-enclosed, cooled by outside air forced in and out through ventilating ducts. Permits safe operation of motors and compressors in the same room, conserves space.

- inert gas-cooled



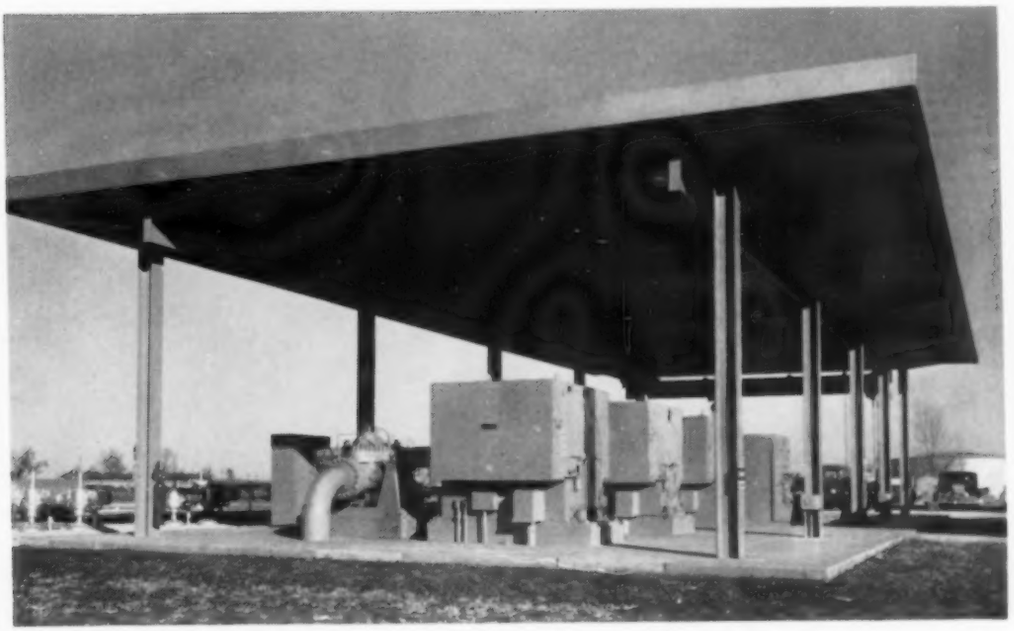
Water-cooled motors with inert gas instead of ambient air circulating over tubular heat exchanger within each motor. The inert gas is introduced at slight pressure to maintain positive pressure within the motor at all times. Eliminates need for expensive explosion-proof enclosures.

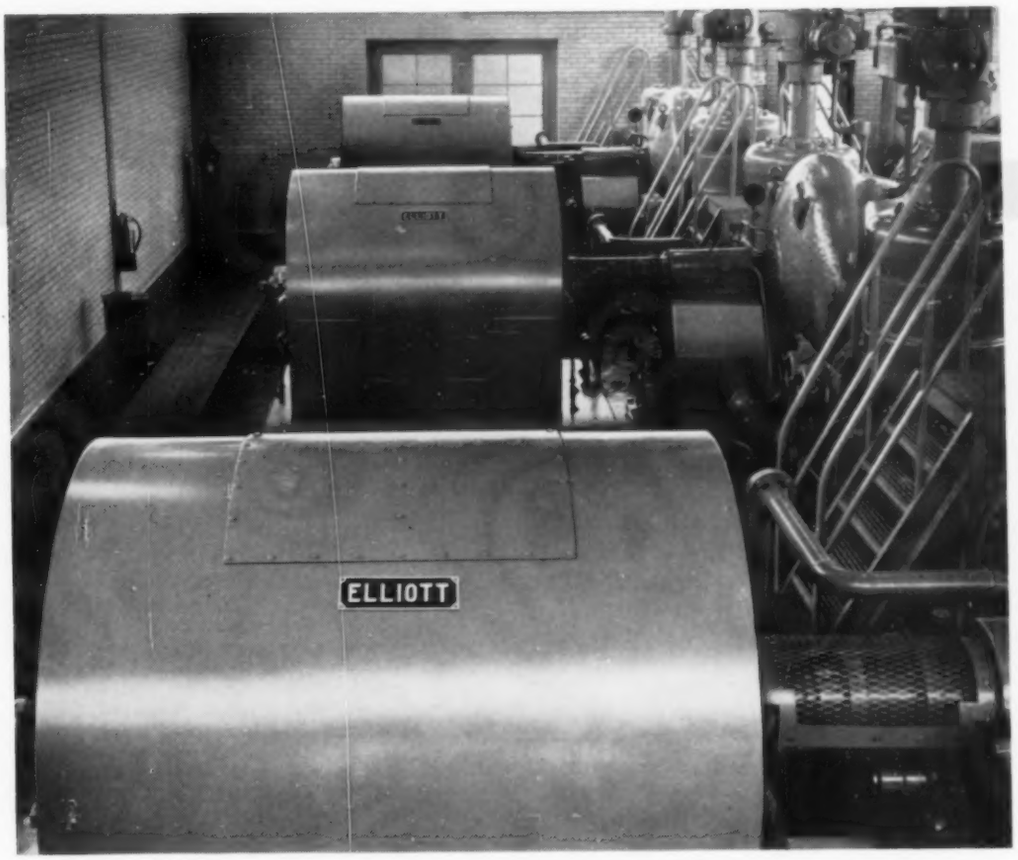
Call us about your specific requirements . . .

Take advantage of Elliott's long experience in solving pipe line pumping problems. It pays. Write or call Elliott Company, Ridgway Plant, Ridgway, Pa., today.

ELLIOTT Company

Four Elliott weather-protected, 2-pole motors serving an outdoor pumping station.





These Elliott base-ventilated, 2-pole motors (all 2500-hp units) are serving a compressor station.

R8-9

KEEP IT CLEAN by Phil Tration

The secret of cruising in orbit
Was told to his canine by Corbett:
"When you're smacked in the face, by stardust in space
Let a Staynew Filter absorb it."

Sputnik, Muttnik, or Whatnik *we've* always known that Dollinger Filters are simply "Out of this World." That's what we've been trying to tell you these past months! But I suppose you've become immune to such claims and just haven't bothered to investigate.

Possibly there is a moral here (If you like morals):

Perhaps your biggest competitor did investigate, and right now a Dollinger Staynew Filter may be helping him make his product better than ever.

Seriously, shouldn't you investigate the design advantages of Dollinger Filters? It will cost you nothing and you may save yourself many headaches.

STAYNEW MODEL CPHS PIPE LINE FILTER

has the exclusive "double action principle." Air is first deflected to outer walls of Filters and forced downward at high speed. Water, oil, and heavier particles of rust, etc. are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter airborne particles. This "double action" design eliminates need for frequent cleaning.

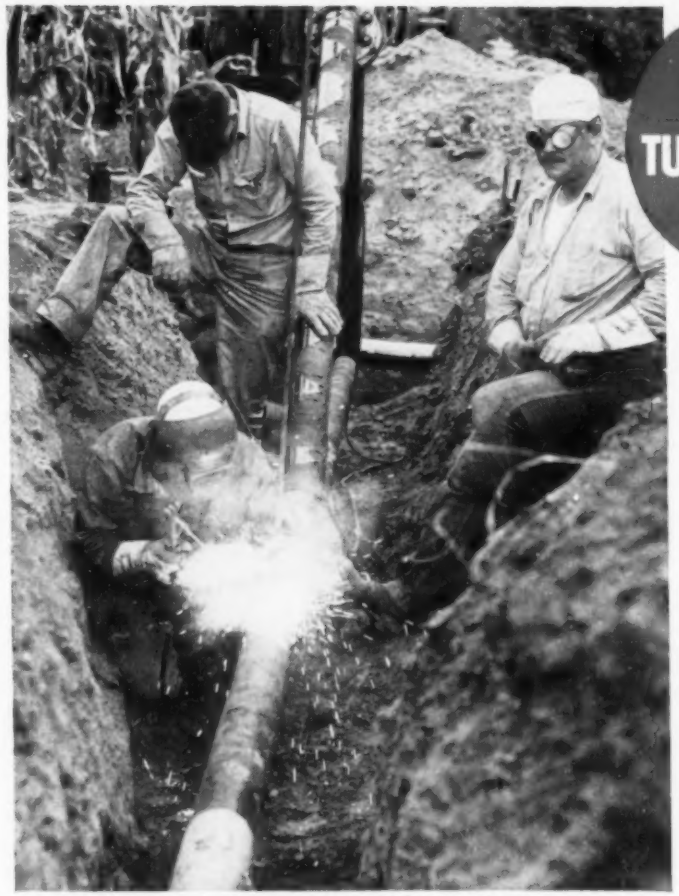
Inexpensive, simple to install, Dollinger Pipe Line Filters pay for themselves in reduced maintenance alone. Why not talk over your filtration problems with a Dollinger engineer . . . or write for Bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 95 Centre Park, Rochester 3, N. Y.

REG. PROTECTOMOTOR U.S. PAT. OFF.

STAYNEW **DOLLINGER**

FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS



Here, valve setting is being tied into 4" line coming from one of the 63 wells. This is the final weld. Valve setting was fabricated at the site from 4" pipe and four TUBE-TURN* 45° Elbows. TUBE-TURN Fittings are known everywhere for their unsurpassed uniformity for perfect fit-up.

tt TUBE-TURN

Valve settings call for *perfect fit-up*

says Ohio Fuel Gas Company

Construction of valve settings is a good test for the skill of pipeliners . . . and the close tolerances of their pipe fittings! And a good proving grounds was a project of Ohio Fuel Gas Company in connecting 63 storage wells to their Pavonia Pumping Station near Mansfield. The pictures tell the story.

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

Welding section with 6" x 4" TUBE-TURN Reducing Tee into 6" gathering line. Joints were cut and bevelled with bevelling machine to assure accurate fit-up of pipe.

Completed tie-in of valve setting into 6" gathering line. This line connects into 12" main to Pavonia Pumping Station. Bottom member of valve setting serves only as a brace.

Completed valve setting in gathering line. This shows two TUBE-TURN 45° Elbows and Welding Neck Flanges. All pipe and fittings are Schedule 40.

TUBE-TURN Welding Fittings and Flanges are MADE IN U.S.A. by

TUBE TURNS

A Division of National Cylinder Gas Company

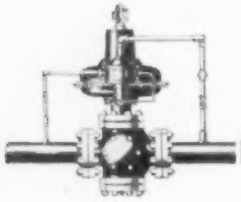
LOUISVILLE 1, KENTUCKY

Available promptly from Tube Turns' Distributors in all principal cities

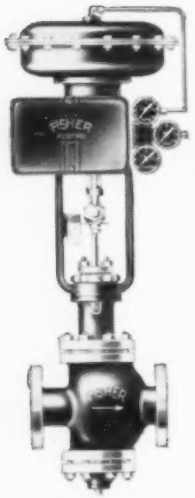
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland • Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle

MADE IN CANADA by: Tube Turns of Canada Ltd., Ridgetown, Ontario • DISTRICT OFFICES: Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec • Vancouver, B.C.

WHAT...a "super market" in this business?



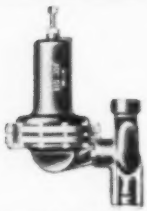
IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...



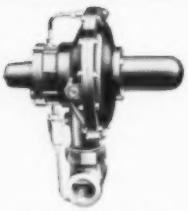
Type 657 with 3500 Positioner

Type 4150 and 4160 Wizard II Pressure Controllers

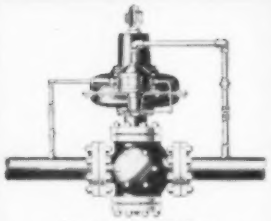
Type 95 Pressure Reducing Valve



Type 630 "Big Joe" Field Regulator



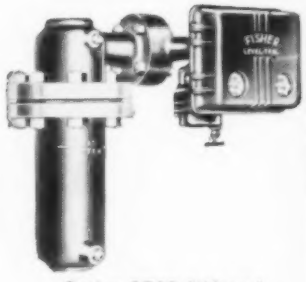
Series 99 Multi-Purpose Gas Regulator



Series 298T Gas Regulators

Type 655-A Pressure Regulator

YES! *now you can shop by phone, wire or TWX...* for shipment within 36 hours!

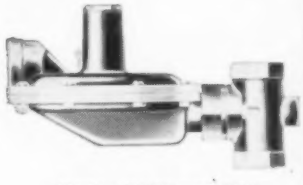


Series 2500-249 and
259B Level-Trols
Cage Sizes 14" and 32"

FACTORY STOCK ALWAYS ON HAND:

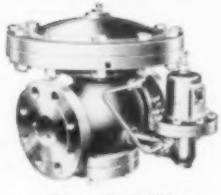
- **Large stock of BORDER & DISTRICT REGULATORS**
- **Wide choice of GAS REGULATORS**
- **Assorted types of MULTI-PURPOSE REGULATORS**

Type 75 Water
Reducing Valve



Series S100 and 730
Service Regulators

Series 620 and 621
Farm Tap Regulators



Type 92B Pilot
Operated Steam
Reducing Valve

Series 67FR
Combination
Filter Regulator

Fisher's new special service department is organized much like a super market to help you meet emergency requirements with dispatch and speed.

A stock of the popular and standard diaphragm control valves, Wizard Controllers, level - trols and all types of gas regulators are kept on the shelf at all times ready to go.

Every Fisher representative receives a weekly list of all available types for the following week.

Now, when you're up against an emergency, phone, wire or TWX (Marshalltown 578 or 579) the factory or your Fisher representative ... your order will be enroute within 36 hours (except Saturday and Sunday) after it is received in Marshalltown.

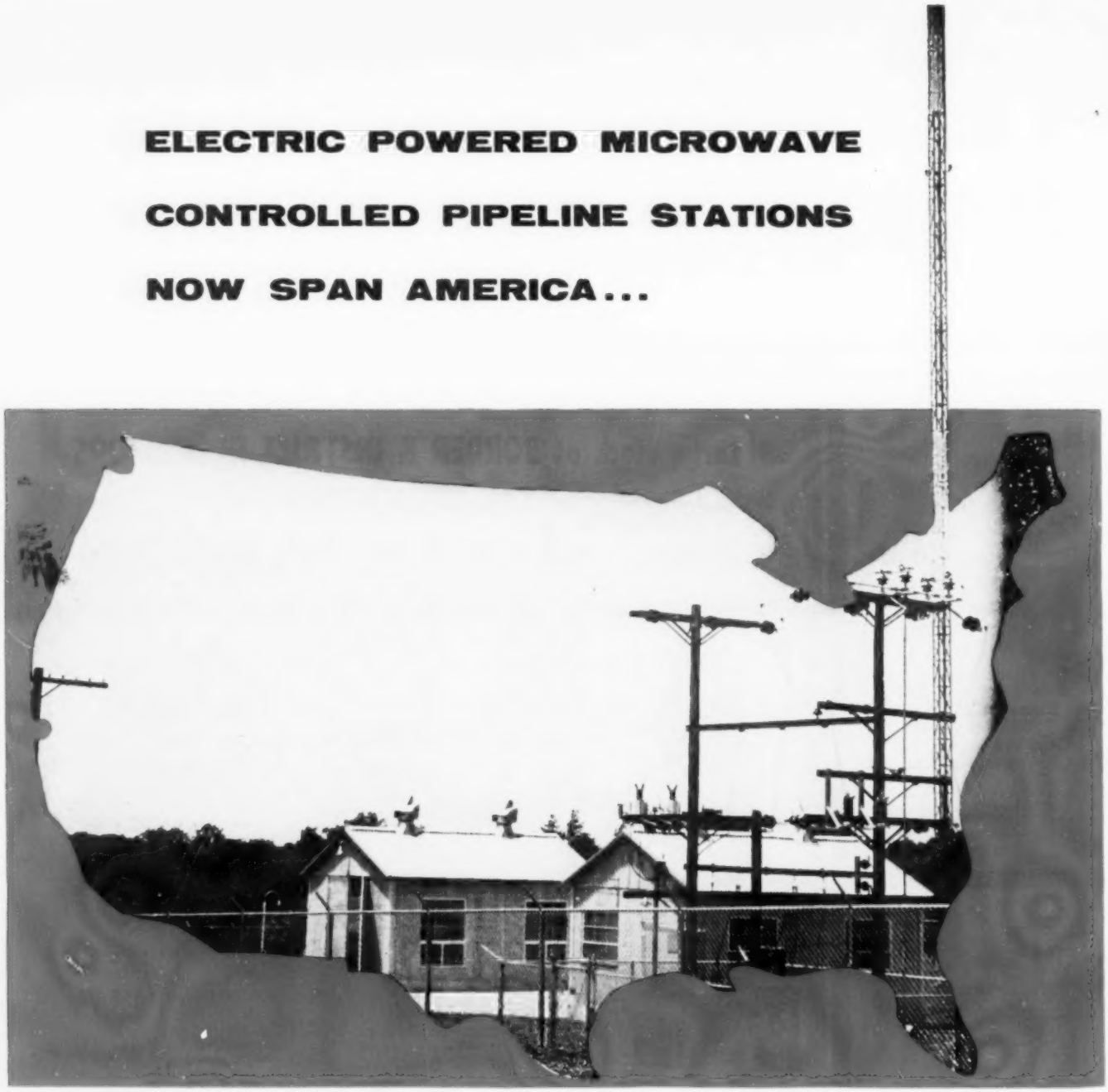
FISHER® Controls

SINCE 1880

FISHER GOVERNOR COMPANY

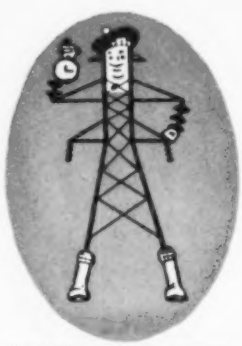
Marshalltown, Iowa/Woodstock, Ontario/London, England

ELECTRIC POWERED MICROWAVE CONTROLLED PIPELINE STATIONS NOW SPAN AMERICA...



One of many ways progressive management puts UTILITY ELECTRIC POWER to work

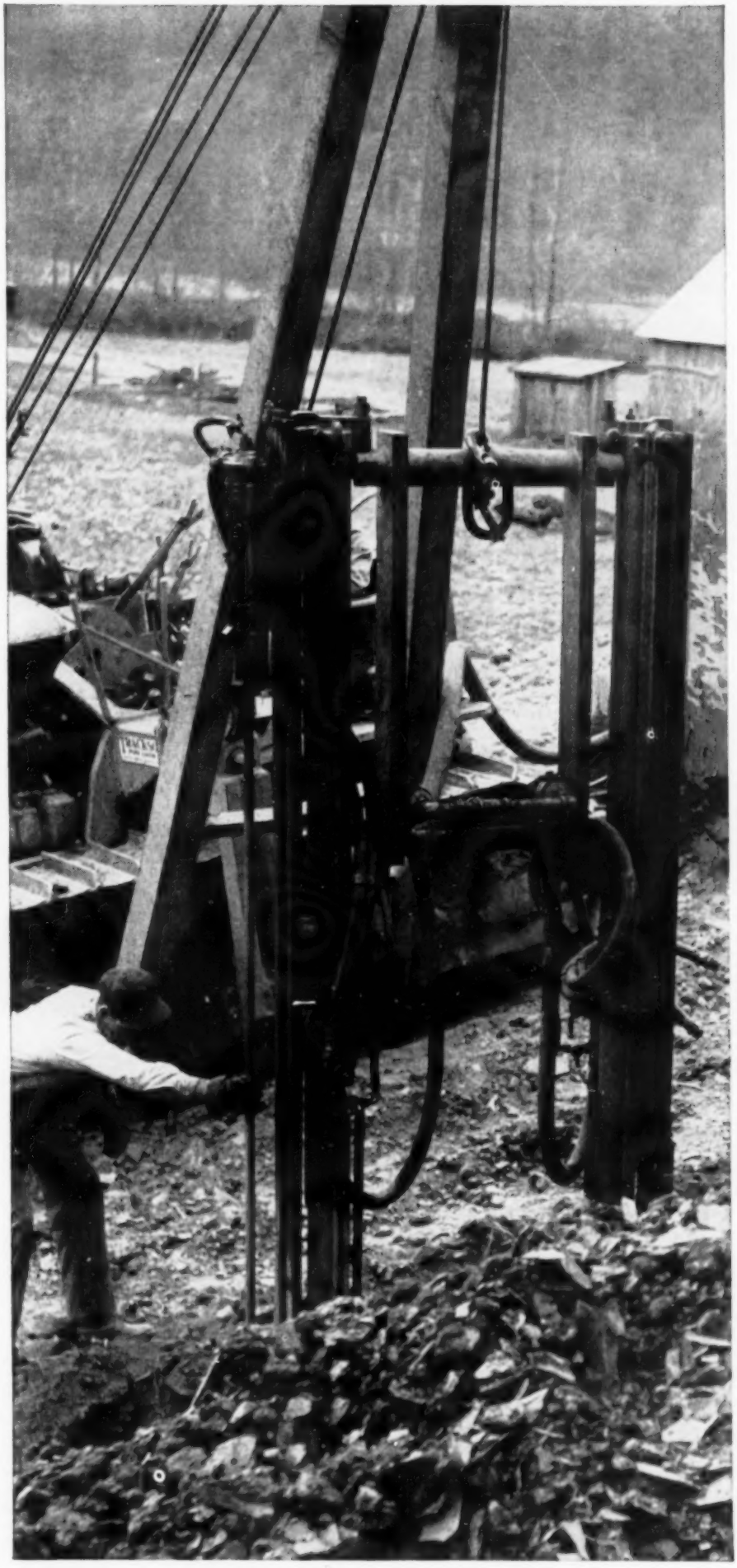
If you are in the pipe line transmission business . . . or if you contemplate having anything to do with pipe line transmission operations, don't sign any contract for power until you have carefully investigated the advantages of UTILITY ELECTRIC POWER. Of the 686,000 miles of pipe line systems in America, a big percentage of these is operated by Electric Power. When you have deliveries to make – at low cost – do it the modern, progressive way. Use UTILITY ELECTRIC POWER.



I'M LCP – Low-Cost Power on the Job 24 Hours Daily

PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. BOX 35006 DALLAS, TEXAS



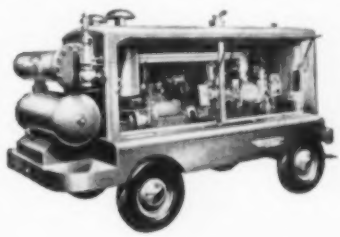
First fully efficient rotary compressor for pipeliners

Puts out full volume with same engine *running 150 rpm slower*

Other "600" rotary compressors produce 600 cfm of air at 100 psi when operating at 1750 or 1800 rpm. The more efficient Jaeger Roto Air-Plus, using the same economical GM Diesel Model 6-71 engine, delivers the same volume at only 1650 rpm.

This difference in efficiency means that, throughout the longer life of your Jaeger compressor, you will produce air with less fuel, fewer feet of engine piston travel and up to 150 fewer revolutions of compressor vanes every minute of every working day. What's more, you'll find engine and compressor so closely regulated that air pressure remains constant under all normal demands.

For full details, check with your Jaeger distributor or write us for Catalog JCR-5. Find out why the Jaeger "Roto" is the top performer for today's top pipeline contractors.



Model "600". Equally efficient performance is offered in "365" and smaller sizes.

The Jaeger Machine Company, 665 Dublin Avenue, Columbus 16, Ohio. Sales, Rentals, Service in over 150 Cities of U. S. and Canada

JAEGER ROTO AIR-PLUS® COMPRESSORS

New 350-mile "Oklahoma Extension"

taps new field...

A. O. Smith furnished 262 miles of the 26-inch pipe. Photo above shows some of the difficult conditions encountered in putting in the line.

Natural Gas Pipeline Company of America puts line into service in late November of '57

This new line (mainly 26-inch pipe) allows Natural Gas Pipeline to augment existing supplies from their fields in the Texas Panhandle. With the new line, they'll be able to increase reserves up to 127,000,000 cubic feet per day from new fields in Jack and Wise Counties, Texas.

The Oklahoma Extension will tie in with the Company's mainline at a point near Fritch, northeast of Amarillo. It represents better than a 10% addition to their present pipeline network that includes 1400 miles for affiliate Texas-Illinois Natural Gas Pipeline Company and 1700 miles for Natural Gas Pipeline Company.

262 miles — of 26-inch pipe was furnished by A. O. Smith. In fact Natural Gas Pipeline Company and A. O. Smith have enjoyed a long and mutually satisfactory association. Over 1000 miles of the 30-inch pipe for the previously mentioned Texas-Illinois line was also supplied by A. O. Smith.

For almost 30 years . . . A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

Through research A.O. Smith *. . . a better way*

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

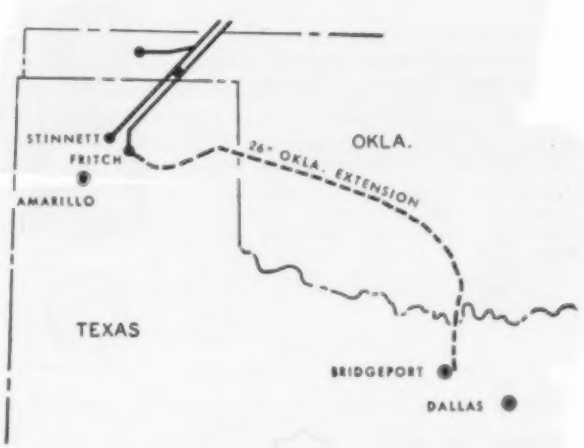
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 35 • Houston 2 • Los Angeles 17 • Midland 5, Texas • New Orleans 12 • New York 17 • Tulsa 3 • A. O. Smith International S. A., Milwaukee 1, Wisconsin, U. S. A.

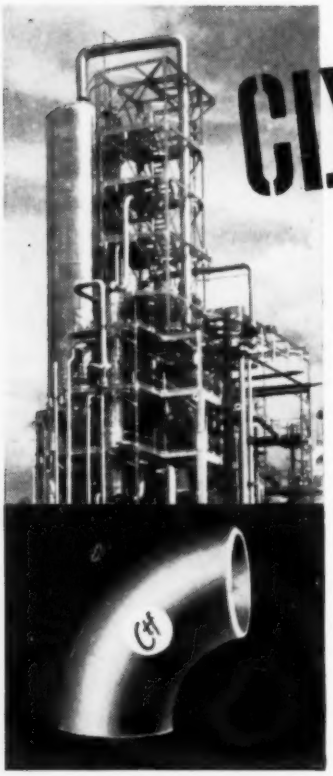
..expands reserves

Construction of the Oklahoma Extension, a four-month project, included erection of suspension bridges to carry the pipe over severely eroded terrain and a number of soil-conserving, erosion-control dams.

The 350-mile line extends from newly tapped fields in Jack and Wise Counties in Texas and swings north into Oklahoma and then back into the Panhandle to tie in with the Company's existing mainline near Fritch, Texas.



For more data on advertised products, use Readers' Service Cards, last page.

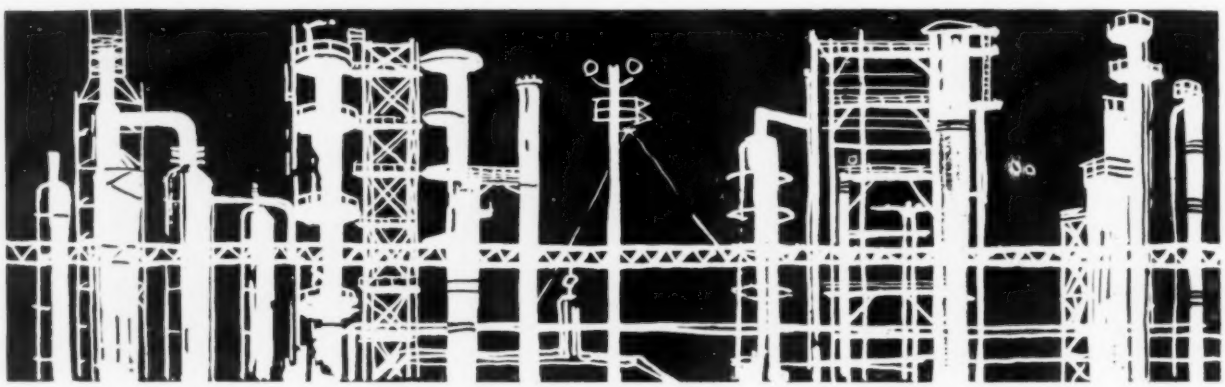


CLYDE FITTINGS

renowned in the world's refineries

The term 'Clyde-built' has brought an old but true meaning of reliability to the oil industry in the making, fabricating and erection of welding pipe fittings. Clyde Tube Forgings make the finest, most dependable pipe fittings obtainable anywhere.
Shaw Petrie Limited have designed, fabricated and erected pipework which has enjoyed a world-wide reputation for years.
Could there be any stronger, trustworthy combination for your pipework problems ?

Every pipe fitting passing through the company is inspected and guaranteed by a Lloyds inspector permanently with the staff.



LONDON OFFICE 157 VICTORIA ST. SW1
TELEPHONE TATE GALLERY 9325-6
AND AT SOUTH SHIELDS, LIVERPOOL AND BELFAST

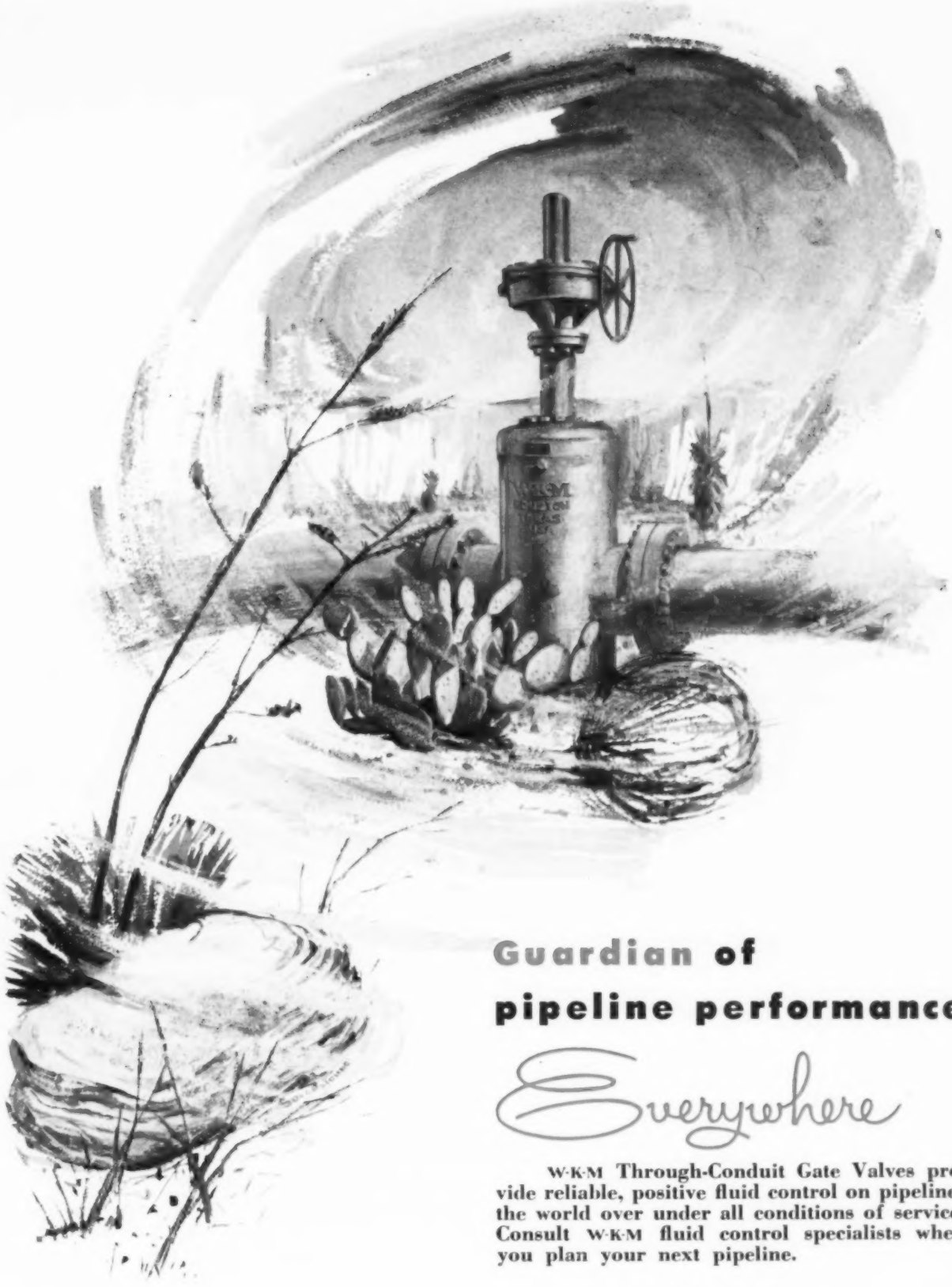
OVERSEAS
CANADIAN CLYDE TUBE FORGINGS
P.O. BOX 278 WESTON ONTARIO

New Zealand	*Barbados*	*Mexico and*
East West	*British Guiana*	*Venezuela*
Central and	*Jamaica*	*Belgium Holland*
South Africa	*Trinidad*	*Norway Sweden*
Australia	*Italy Spain*	*and Finland*

SHAW-PETRIE LTD

NORTH HILLINGTON, GLASGOW S.W.2

CLYDE TUBE FORGINGS LTD



Guardian of pipeline performance

Everywhere

W-K-M Through-Conduit Gate Valves provide reliable, positive fluid control on pipelines the world over under all conditions of service. Consult W-K-M fluid control specialists when you plan your next pipeline.

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

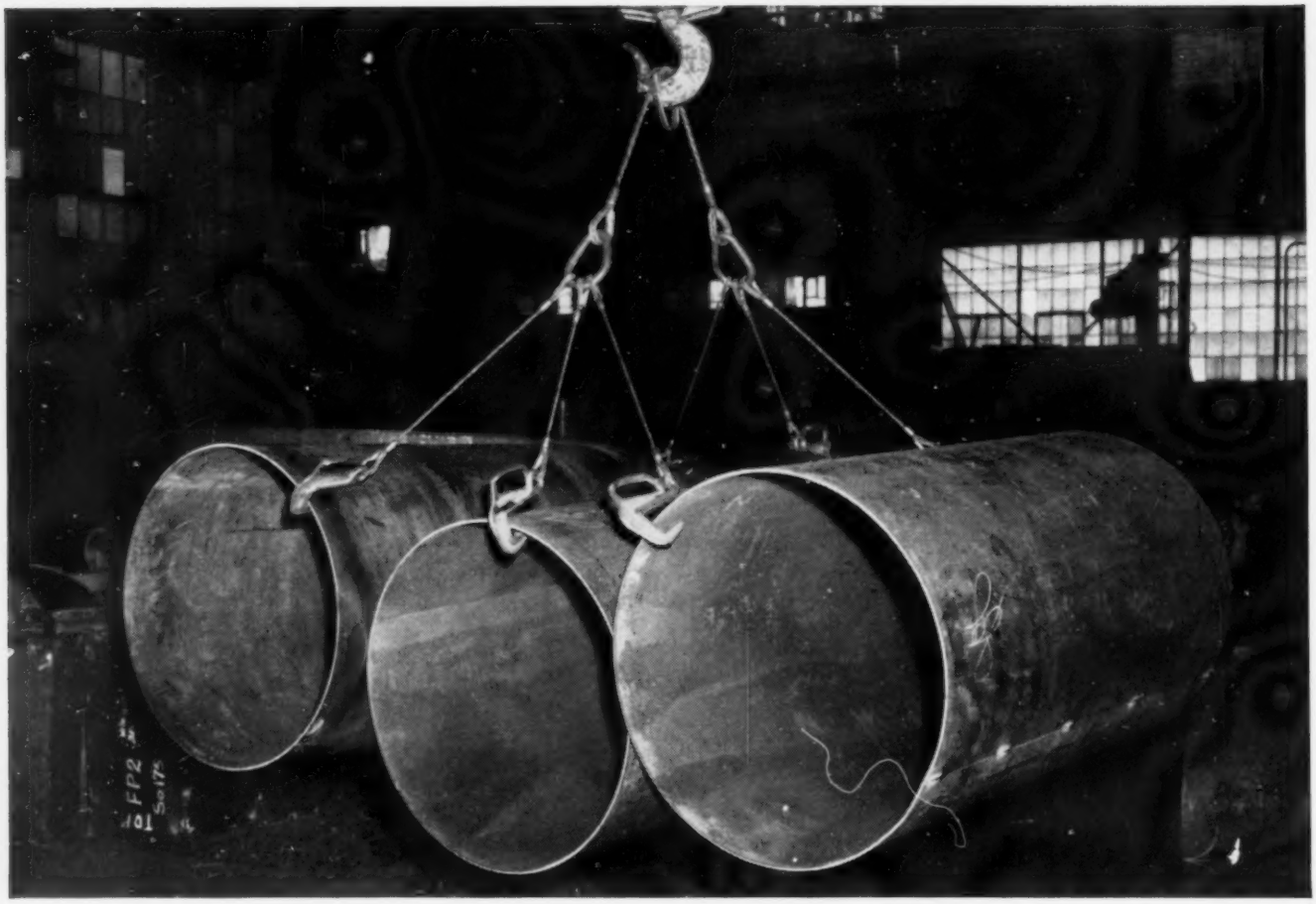
HOUSTON, TEXAS

5707

MANUFACTURERS OF W-K-M GATE VALVES · ACF LUBRICATED PLUG VALVES

KEY-KAST ALLOY STEEL PIPING FITTINGS · KEY RETURN BENDS AND FITTINGS

For more data on advertised products, use Readers' Service Cards, last page.



Tuffy®

Slings and Hoist Lines

now...thanks to Tuffy...three make the trip instead of one

The Toronto Iron Works makes tanks on a production line basis. Plate steel is rolled and welded into 8′-long tank sections at one end of the plant. The sections are picked up by an overhead crane and transported to the far end for final assembly. Formerly they were carried on a chain... a single section per trip, tying up the crane all day.

In the course of a plant survey, which is a valuable part of the service rendered by Tuffy distributors, a better idea came up. Why not make a rigging of Tuffy Slings ...handle all three sections of a tank at the same time... free the crane for other work? That's exactly what is happening in the picture above. Result: easier handling. ⅔ less crane time, big production-dollar savings. Further result, in the words of a company official:

"This was the first time this plant used Tuffy Slings. Now they have standardized on them."

Tuffy Slings are ideal for this job (and countless others) because of their superb combination of super-strength and free-flowing flexibility. It's just about impossible to kink a Tuffy Sling; and if you should, the kinks smooth out with no damage done.

Another Tuffy plus feature: Tuffy's pressed-on ferrule is applied over tuck splices under tremendous pressure to give the sling eye 100% of fabric strength.

Your Tuffy Distributor: a Good Man to Know

He's stocked to meet your needs; ready to make fast delivery of your Tuffy Slings, Tuffy Hoist Lines (famous working partners of Tuffy Slings), and Union Wire Rope. And he's qualified to help you find money-saving ways of using Tuffy products in your operation. Get in touch with him.

FREE! Tuffy Sling Handbook

Gives full data on Tuffy Sling types, uses, dimensions, weights and rated loads. Plus a complete rigger's manual and engineer's handbook on wire rope constructions and specifications. Write for your copy now.

union Wire Rope corp.

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand

2278 Manchester Avenue **Kansas City 26, Mo.**

The SIE® Compressor Start Unit

. . . makes full pipeline automation as close as tomorrow!

Start now to provide full automation of pipeline control systems by installing the SIE Compressor Start Unit . . . the basis of tomorrow's completely automatic, and today's semi-automatic, operations. *Right now* the SIE Compressor Start Unit offers these important advantages in daily operation:

- Realize greater throughput and increase employee efficiency by automating this vital phase of compressor station operation.
- Handle remote starting and receive immediate visual signals indicating compressor malfunction.
- Eliminate human error by handling entire compressor starting sequence automatically.
- Addition of an SIE Computer Controller will provide full compressor station automation.

Ask SIE for complete information on SIEMARC (SIE Monitoring and Remote Control) to learn how immediate installation of the Compressor Start Unit will advance the date of full automation of your pipeline system, and increase station efficiency in the meantime.

Industrial Instrumentation for Industrial Progress

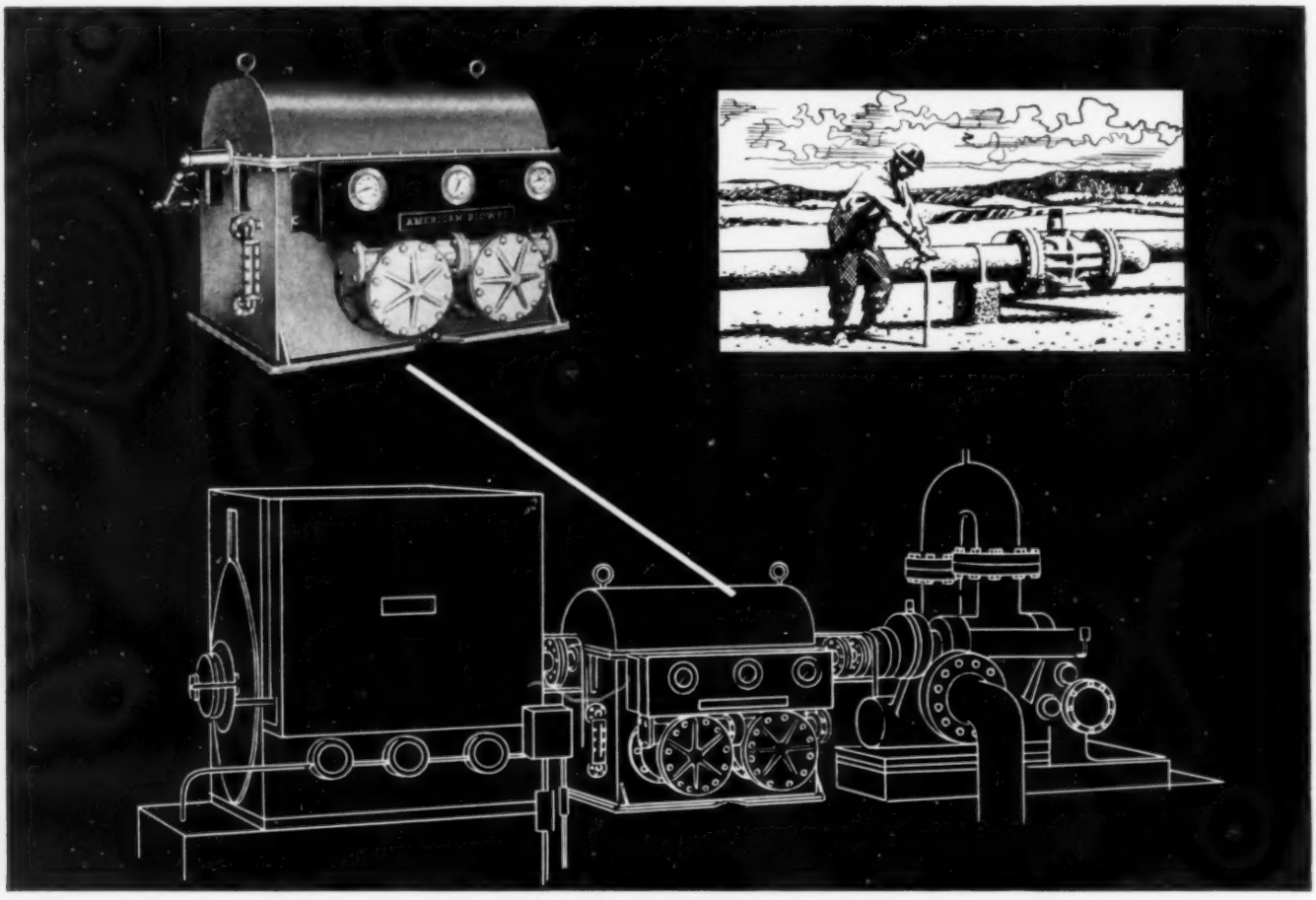
SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO.

P.O. Box 13058 2831 Post Oak Rd. Houston 19, Texas

238 58

AMERICAN BLOWER *Gyrol*® FLUID DRIVE . . .



Class 6 Type VS Gyrol Fluid Drive, 250 hp to 12,000 hp, speeds to 3,600 rpm.

How to get more through-put per kw consumed at pipeline pumping stations

You save power dollars in pipeline pumping stations with American Blower Gyrol Fluid Drives. Used with standard, single-speed induction motors, the stepless, adjustable-speed Gyrol units control pump flow and pressure to give the desired output at the lowest power consumption.

For many years, the dependable Gyrol Fluid Drive has satisfied the automation requirements of the power plant industry for driving centrifugal boiler-feed pumps and fans. Now, the same reliable Gyrol Fluid Drive is providing the ideal means of remote-controlled power transmission for the centrifugal pumps in unattended pipeline pumping stations.

Whether you're pumping a single product or multiple products of various densities, here's how you benefit with the Gyrol Fluid Drive:

- Lower demand charges
- Power savings by adjustable pump speed
- No-load motor starting
- Wide range of pump control, permitting complete flexibility whether one or several products are being pumped
- The use of standard induction motors and Gyrol Fluid Drive to provide a safe, dependable power combination

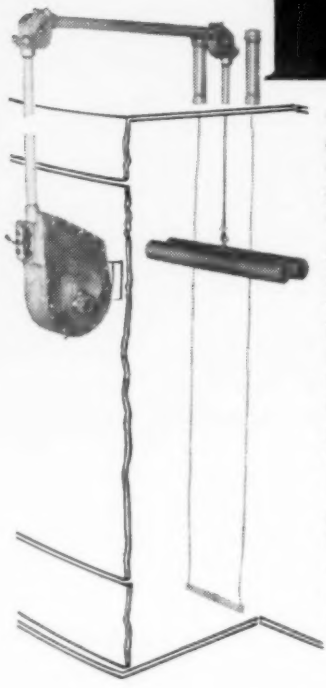
Call your American Blower branch office for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of AMERICAN-Standard

For top storage tank efficiency— get Wheaton *precision* in both

Wheaton T-1600-C Ground Reading AUTOMATIC TANK GAUGE

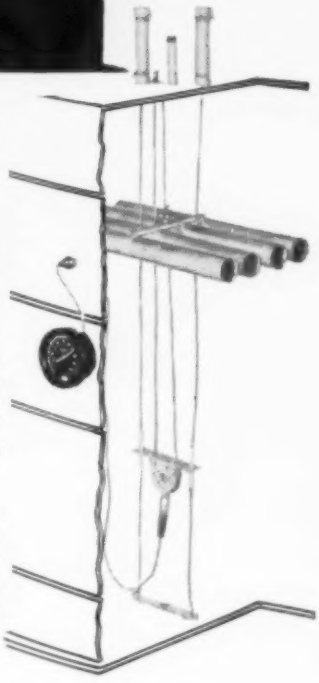


The Wheaton T-1600-C Tank Gauge, designed for cone-roof tanks, permits accurate gauging without having to climb the tank.

It features an easy-to-read stainless steel tape for optimum visibility; large float area for highest sensitivity; stainless steel shafts and custom-fitted teflon bearings which minimize friction; "H" float which permits easy fastening to guide wires without special guides.

For maximum accuracy with minimum maintenance, install the Wheaton T-1600-C Gauge on your cone-roof tanks. Gauges also available for floating and movable roof tanks.

Wheaton T-1695 Ground Reading MID-POINT THERMOMETER



The Wheaton T-1695 Mid-point Thermometer fully meets the requirements of A.P.I. Standard 2500.

A float guided by spring-loaded guide wires follows the liquid surface and, by pulley, positions the thermometer element at half the liquid height. A Mercury bulb thermometer is connected by a stainless steel capillary tube to a dial type indicator (calibrated from 0° to 100° F) located outside the tank.

Standardize now on the Wheaton T-1695—an easy-to-read thermometer that meets all storage tank requirements for accuracy and reliability

Mail coupon now for full information

WHEATON BRASS WORKS, UNION, N. J.

Manufacturers of Loading Arm Assemblies, Swing Joints, Loading Valves, Tank Fittings and Truck Tank Equipment

Foreign Manufacturers

Emco Limited, London, Ontario, Canada • Emco Brass Mfg. Co. Limited, Margate, Kent, England
Worthington Corporation, Rio De Janeiro, Brazil, S. A.

Tank Fittings by Wheaton

the best by every standard

WHEATON BRASS WORKS, UNION, N. J.

Please send full information on

- ☐ Wheaton T-1600-C Tank Gauge
- ☐ Wheaton T-1695 Mid-point Thermometer
- ☐ Send copy of new Wheaton Catalog No. 65

Name .....

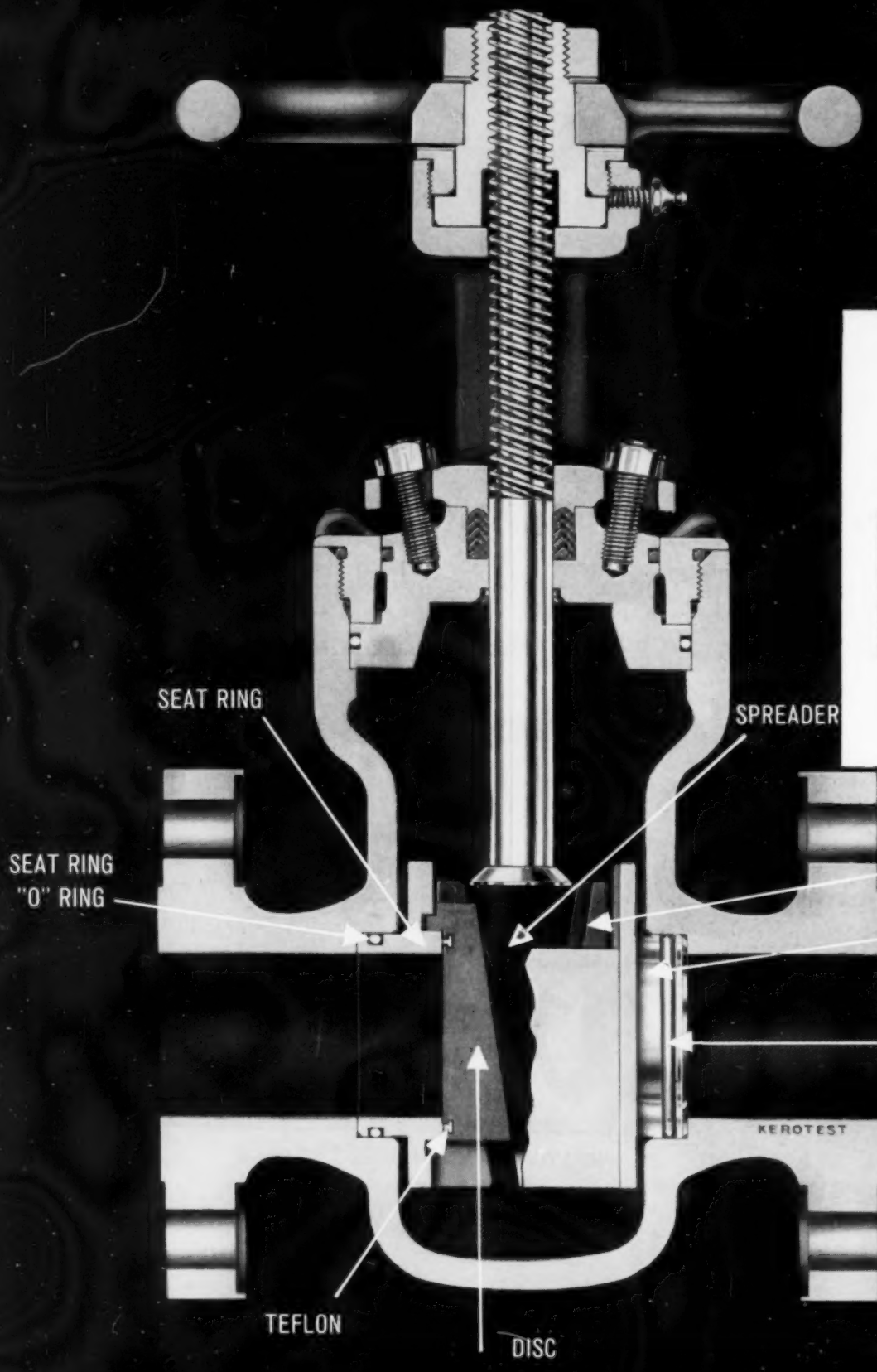
Company Name .....

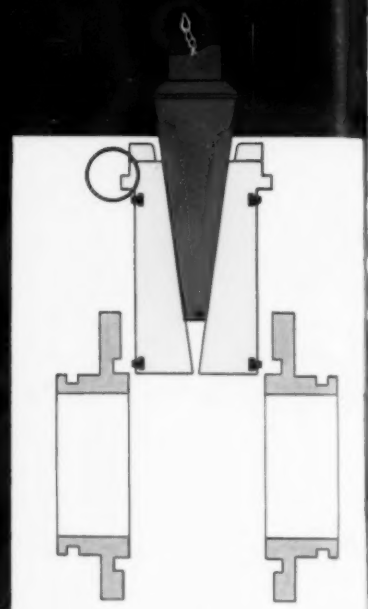
Street .....

City ..... Zone ..... State ..... P

This NEW vapor-tight, optional flow, dou

Non-lubricated



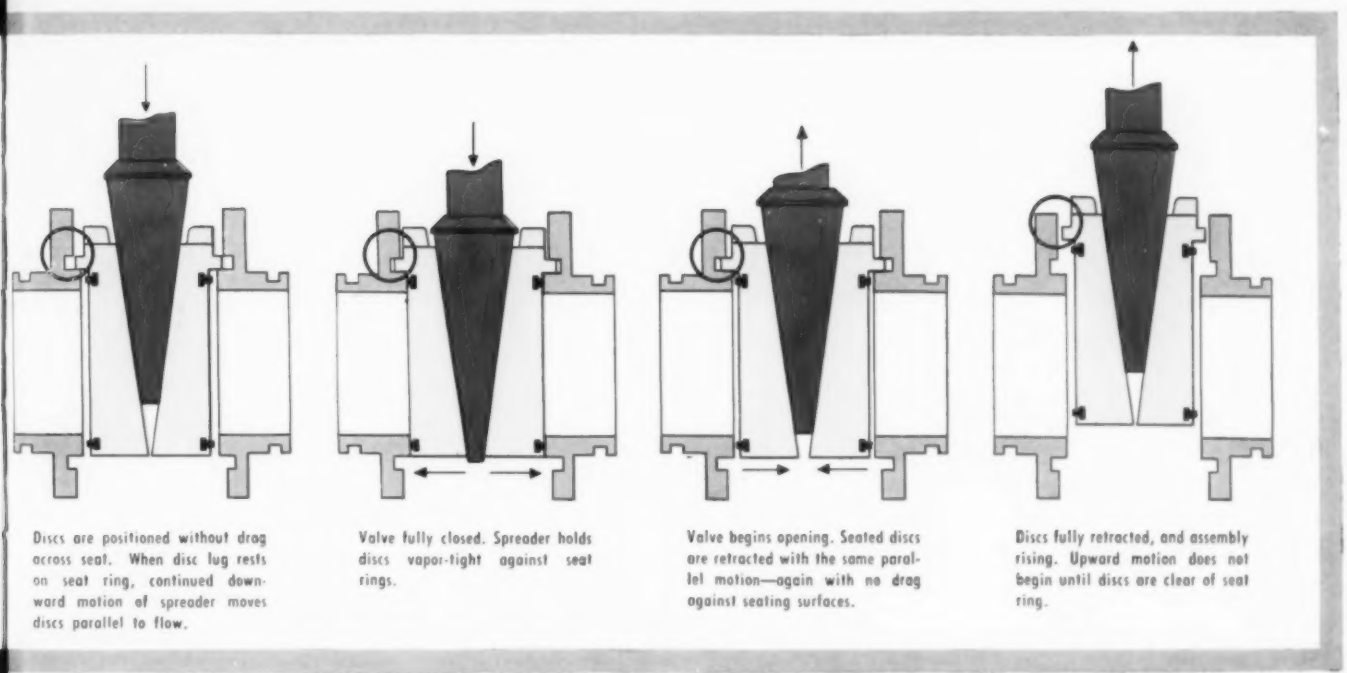


Valve fully open. In closing, discs and spreader move down, perpendicular to flow.

double block and bleed, full opening,

KEROSEAL® VALVE

handles gases, petroleum products and petrochemical fluids



Discs are positioned without drag across seat. When disc lug rests on seat ring, continued downward motion of spreader moves discs parallel to flow.

Valve fully closed. Spreader holds discs vapor-tight against seat rings.

Valve begins opening. Seated discs are retracted with the same parallel motion—again with no drag against seating surfaces.

Discs fully retracted, and assembly rising. Upward motion does not begin until discs are clear of seat ring.

More than two years of laboratory and field testing have clearly demonstrated the fact that the new KEROSEAL offers advantages not found in any other valve.

The KEROSEAL valve gives a vapor-tight seal without the continued and costly use of sealing lubricants. An effective new method of guiding the disc assembly, completely independent of the valve body, maintains clearance between discs and seat rings during operation, eliminating wear, frictional drag, wiping, and consequent galling of the seating surfaces.

Primarily, these advantages are the result of an entirely new principle of operation. The stem carries a spreader, on which are mounted a pair of discs. A Teflon sealing ring is mechanically bonded to each disc.

When the valve is being closed, the discs move downward, without friction. This downward travel automatically ends when discs are correctly positioned in relation to the seat ring. At this point, further movement of the stem initiates the spreader action, forcing the discs against the seat rings.

In opening, the first movement of the stem retracts the discs so that they clear the seat rings, and further movement raises the discs until they reach the fully open position.

The new KEROSEAL valve is described in detail in this new full-color bulletin. *Write for your copy today.*

KEROTEST

KEROTEST MANUFACTURING COMPANY

2516 Liberty Avenue, Pittsburgh 22, Pa.

In Canada, Kerotest products are manufactured and distributed exclusively by Guelph Engineering Company, Guelph, Ontario.

Patent Applied For

MAJOR PIPELINES EVERYWHERE

are served better by the very best...
Walworth Lubricated Plug Valves

Walworth Cast Steel Lubricated Plug Valves enjoy a long record of successful service on pipelines the world over. In design, construction and performance they stand unsurpassed.

Other Walworth products include Gate, Globe, Angle and Check Valves in a wide range of types and sizes for the oil and gas industries. Sold by distributors in principal centers throughout the world.

WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. · CONOFLOW CORPORATION · GROVE VALVE & REGULATOR CO. · SOUTHWEST FABRICATING & WELDING CO., INC. · M & H VALVE & FITTINGS CO. · WALWORTH COMPANY OF CANADA, LTD.

OIL AND GAS

GATHERING LINES

gathering systems rely on Youngstown electric weld line pipe for long, trouble-free field performance

Youngstown Pipe has been used for 31 years in America's largest gas and oil field gathering systems. Quality-controlled through every production operation, it provides: Easy bending, uniform wall thickness, excellent line-up characteristics, outstanding weldability and longer lengths. Thus, Youngstown Line Pipe speeds and simplifies the laying of gathering lines.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Producers of Carbon, Alloy and Yoloy Steels
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

For more data on advertised products, use Readers' Service Cards, last page.

PROVEN!

THE ONLY SIDE BOOM ON RUBBER TIRES

SOONER BOOMER

LOW-COST SOONER-BOOMER DOES THE WORK OF 2 CONVENTIONAL MACHINES!

The Sooner-Boomer is the world's first side boom mounted on rubber tires. Designed to handle pipe up to 10", this revolutionary machine eliminates unnecessary right-of-way damage on city work —eliminates the need of pipe stringing along city streets ahead of ditch. A low center of gravity makes the Sooner-Boomer highly stable, loaded or unloaded. It operates at road speeds on back haul, and is equipped with a swamper platform. A 12-foot boom makes it possible to lower in over spoil. Power up and power down on all cables assures ultimate safety and precision line-up. The Sooner-Boomer easily lowers in or bends 8-inch pipe. Excellent performance on clean-up and ditch dressing. The Sooner-Boomer is designed to put all weight on wheels, eliminating any strain on engine, transmission and differential. The versatility of the tractor unit makes it possible for the Sooner-Boomer to do the work of two conventional machines!

OPTIONAL: 7-foot angle dozer; rearend winch; 8 forward and 2 reverse speed transmission; trailer hitch; 3-pin connected, boom mounted bending shoe (available in 2, 4, 6 and 8" sizes).

LIFTING CAPACITY
4 Ft. Radius 3750 lbs. plus
8 Ft. Radius 2450 lbs. plus
10 Ft. Radius 1500 lbs. plus

USING FORD SERIES 600 AND SERIES 800 TRACTORS

Check These Features

- **Mounted On Rubber-Tire Tractor!**
- **Highly Maneuverable at 26 MPH Road Speed!**
- **Power Steering!**
- **No Hauling Problems!**
- **All-Hydraulic Operation!**
- **Hydraulic Controlled Counter Weights!**
- **Perfect Operator Visibility!**
- **12-Foot Boom Handles 10" Pipe!**
- ***Lowest Initial Cost!***
- ***Lowest Operating Cost!***
- **Six months warranty from date of purchase on both the tractor and SOONER BOOMER!**

223 W. BRITTON ROAD, OKLAHOMA CITY

P. O. Box 8832, Phone TRinity 8-4033

Canadian Office: 295 Kipling South, Toronto, Canada

PIPE LINE PANORAMA

Government In—Industry Out . . . Government move to curb pipe line industry participation in government affairs that affect pipe lines is picking up steam. Interstate Commerce Commission has abandoned working relationship with API in making pipe line valuations—the bases for determining allowable rates and dividend payments. Instead, government advisory committee will do API's work, then pass recommendations on to ICC.

Also, Justice Department is exerting pressure to put government chairman in charge of National Petroleum Council. Move may mean end of NPC in its present form.

Longer Life for Bearings . . . Recently completed research (See Page 36) reveals the following valuable tip on bearings: A new radioactive tracer method has proved successful in measuring connecting rod bearing wear. Bearings are tested 12 hours, using antimony-124. Observed radioactivity increase is expressed as bearing weight loss.

Uncertainty Clouds Middle East Pipe Lines . . . Two problems are plaguing Middle East oil operators: How to get Sahara's vast crude potential to the ports for export—and what they will do with it after it gets there. Markets are not shaping up.

Even so, a Shreveport, La., contractor reports he is completing deal with the French to build $40 million, 18-inch crude line from Sahara's Hassi Messaoud field to Mediterranean. Project would be completed in one year, with payment coming from 20 percent of the oil shipped through the line. Meanwhile, despite rebel forces sabotage threat, French will attempt to operate newly completed 125-mile, 6-inch line from Hassi Messaoud field to railhead at Touggourt.

One answer to gas market problem is under study by French government: Build gas line across Mediterranean to Southwest France.

AGA Studies Pulsation Problems . . . Better ways to solve the problem of errors in orifice meter readings resulting from pulsations are now under study by American Gas Association (See Page 41). One possibility is to consider wave motion and acoustics in design of measurement stations. Some preliminary progress has been made, but researchers say not to expect any sweeping solutions to the problem right away. It will take time—maybe years.

Washington Panorama . . . There is little prospect of Supreme Court ruling on Memphis decision this year (See January PLI). Result: Pipe line expansion plans are being at least temporarily stalled; some companies, i.e., Colorado Interstate, are facing serious financial problems . . . **Legislators say Harris-O'Hara bill** will be up for House vote before March 1. Coal and consumer interests have put in early attacks against the bill. However, several legislators believe differences can be settled and passage assured — if gas industry gives full support . . . **Federal Power Commission has authorized Texas Eastern** to convert Little Inch pipe line from gas to product service, under conditions asked by barge operators.

Canada Asks Revision of Imports Curb . . . Canadian government, unhappy over recent U. S. import restrictions, has made strong request that curbs be removed from crude entering U. S. via pipe lines. Canada's Finance Minister Donald Fleming says limiting crude imports from his country will in no way improve U. S. national security. Request will be considered by U. S. in March when new imports program, scheduled to start July 1, will be considered.

Radioactive tracers used to measure bearing wear

By M. W. Savage and L. O. Bowman
California Research Corporation
La Habra, Calif.

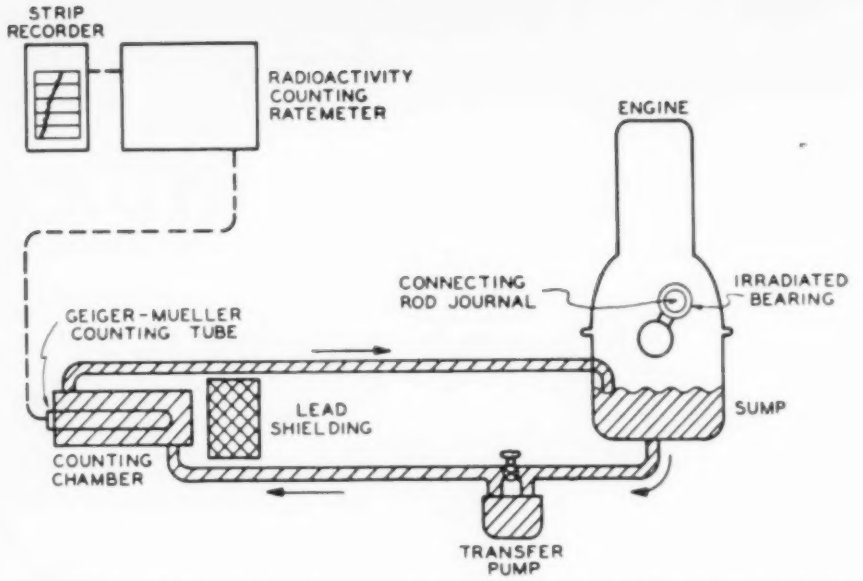


FIGURE 1—This is the bearing wear test apparatus. An irradiated bearing is installed on a connecting rod journal near center of a multi-cylinder engine. A middle journal is used to reduce radiation hazard to front and rear of engine. Wear particles from the irradiated bearing accumulate in lubricating oil which is continuously circulated by transfer pump through the counting circuit. Radioactivity level is counted and recorded using a Geiger tube, counting ratemeter, and recorder respectively. Lead shielding is placed between counting chamber and test bearing, which are approximately 15 feet apart, to insure a low background radiation level at the counting chamber.

The use of "tagged" bearings aid in the study of bearing lubrication. Designers can predict the effect of changes in bearing design and lubricating oil properties on normal rubbing wear.

EFFORTS TO REDUCE bearing failures in the field have received added impetus from the development of a method of measuring bearing wear as it occurs with radioactive tracers.

Work conducted by the authors has shown:

- Connecting rod bearing wear using babbitt-surfaced bearings can be determined rapidly by using a radioactive tracer technique.
- The data indicate that relative connecting rod bearing wear at different operating conditions can be predicted using the load carry-capacity concept.
- Bearing wear is a function of the magnitude and source of the maximum bearing load.
- The most severe bearing wear occurs during engine starts or at extreme high speed operation.
- Bearing wear is lower with an SAE 30 grade motor oil than with an SAE 10W grade motor oil.
- Bearing wear is lower with an SAE 10W-30 grade motor oil than with an SAE 30 grade motor oil.

Bearing failures in the field are due mostly to dirt, misassembly, misalignment, and fatigue. Normal rubbing wear, the principal concern of this report, is defined as the wear occurring when the oil film is not adequate to prevent bearing contact. This contributes to a lesser degree to bearing failures and is a constant source of study by bearing and lubricating oil designers.

Tracers Measure Wear. In the test program conducted by the authors, either babbitt bearings or hard alloy bearings overlayed with babbitt were used. The investigation was confined to the lead base babbitt material because that type appears to be in most common use at this time. The uniformly dispersed antimony is the only element in babbitt alloys that retains radiation energy long enough to permit engine testing, and bearings containing 2 to 8 percent antimony have been used successfully.

Bearings are placed in an Atomic Energy Commission reactor at Oak Ridge, whereupon the radioactive isotope antimony-124 is produced. This isotope is excellent for wear testing because of its long half-life of 60 days and its high radiation energy.

How Test Is Conducted. Figure 1 shows schematically a flow diagram of the test apparatus. A typical test is conducted as follows: Charge the engine with test oil, start the engine and transfer pump, and flush the engine and counting system for 15 minutes. Drain the flush oil and recharge with fresh test oil. Turn on the transfer pump and radioactivity counting apparatus, then start the engine. Warm up at low speed and load until the oil temperature reaches 150° F., then set the desired test speed and load. When the operating conditions and bearing wear rate have reached equilibrium, the test is started. The test is run for 12 hours, and the increase in radioactivity level during the test period is noted. The observed radioactivity increase is then expressed as bearing weight loss by referring to the radioactivity of a standard solution which contains a

known weight of irradiated bearing material.

Wear Mechanism Explained. An explanation of the probable bearing wear mechanism will aid in a better understanding of the results to be discussed. Visualize a connecting rod journal and a bearing with clearance space completely surrounding the journal. If a load is applied at any point on the bearing, the bearing will move towards the journal surface. When there is relative motion between the two surfaces, wear will occur if the surfaces contact each other. The load being applied to the bearing must be transmitted to the journal. During the major portion of engine operation, the load is transmitted by an oil film of sufficient thickness to prevent wear. The oil film is of inadequate thickness at certain times during an engine cycle however, and the two bearing surfaces contact each other briefly, resulting in wear.

The oil film's ability to carry load in a connecting rod bearing depends on several factors. One primary factor is the complex pattern of bearing loading. An analysis of the pattern of bearing loading and its effect on oil film load carrying capacity follows.

The load on a connecting rod bearing at any point during an engine cycle is approximated very closely by a summation of three forces:[1] (1) the gas force acting on the piston, (2) the inertia force due to the reciprocating piston assembly and small end of the connecting rod, and (3) the centrifugal force due to the rotating mass of the large end of the connecting rod and the bearing. In calculating the inertia forces, the common method is to consider the rod as having two component masses, concentrated at either end of the rod.

Figures 2 and 3 show bearing load diagrams typical of two extremes of engine operation. These were calculated for the engine equipped with the irradiated bearing. Figure 2 shows that when the engine is operated at high engine load-low speed conditions the maximum connecting rod bearing load occurs at about 20° after top dead center on the power stroke. This is due to high gas pressure, which is a function of engine torque. In contrast, Figure 3 shows that when the engine is operated at low engine load-high speed conditions the maximum

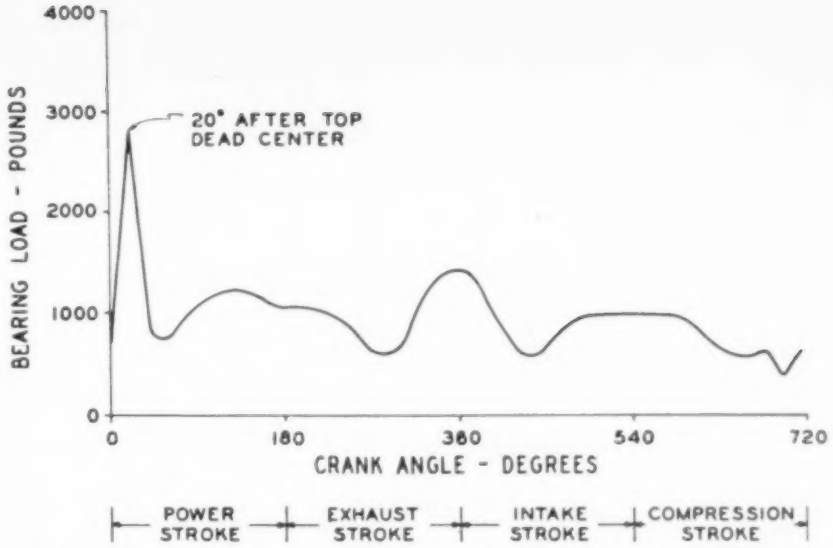


FIGURE 2—Maximum connecting rod bearing load occurs at about 20° after top dead center of power stroke when engine is operating at high engine load, low speed, 45 bhp and 2500 rpm.

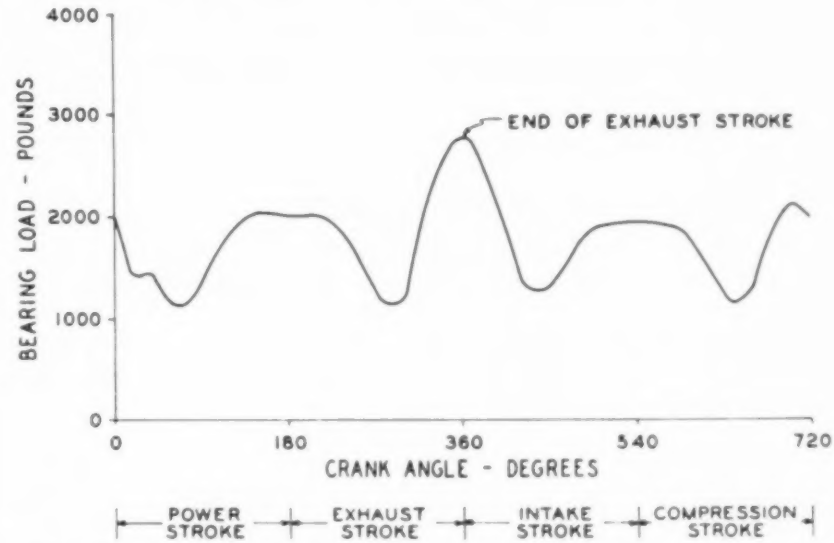


FIGURE 3—Maximum bearing load occurs at the end of the exhaust stroke when engine is operated at low engine load, high speed, 0 bhp, 3500 rpm.

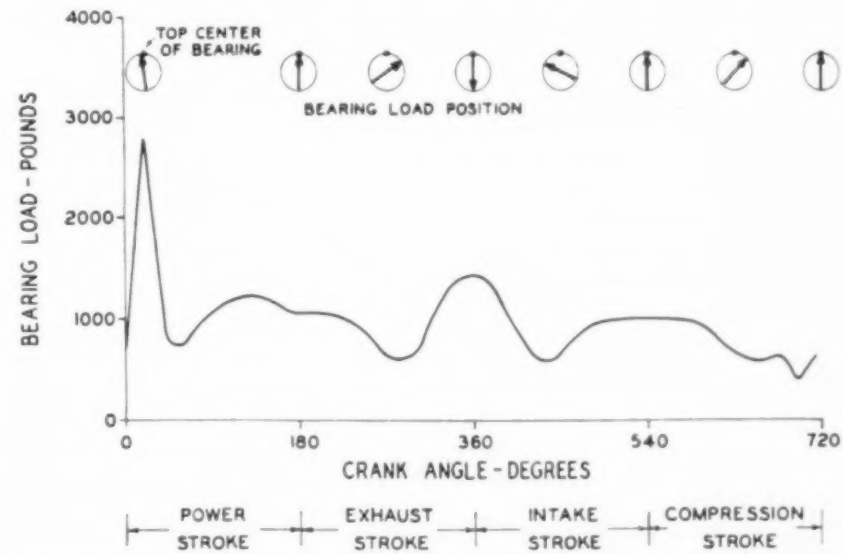


FIGURE 4—Calculated load positions at several points in an engine cycle at high engine load, low engine speed, 45 bhp, 2500 rpm.

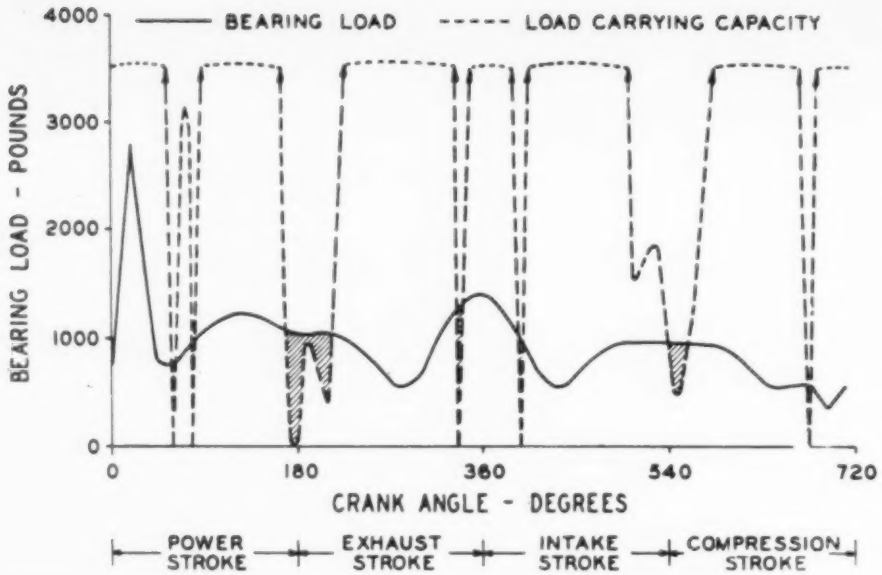


FIGURE 5— Theoretical bearing wear diagram at high engine load, low engine speed, 45 bhp, 3500 rpm.

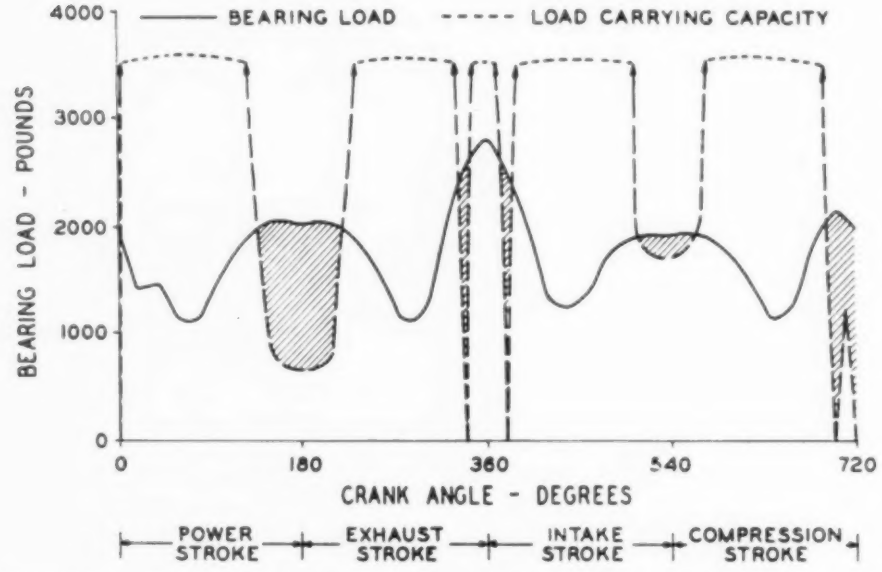


FIGURE 6—Theoretical bearing wear diagram at low engine load, high engine speed, 0 bhp, 3500 rpm.

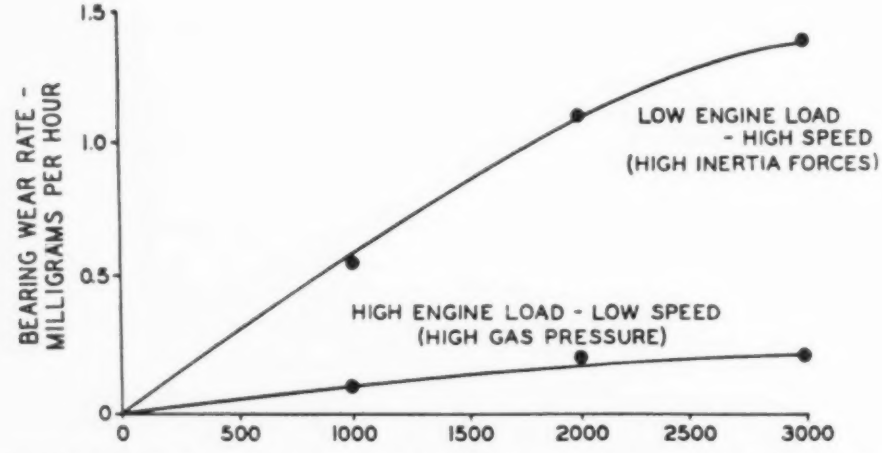


FIGURE 7—Radioactive tracers show that higher wear rate occurs under low engine load-high speed conditions than under high engine load-low speed conditions for given values of maximum load bearing. (Oil temperature—195° F.)

bearing load occurs at the end of the exhaust stroke. This is due to high inertia forces, which are a function of engine speed.

Loads Change. As shown in Figures 2 and 3, the connecting rod bearing loads change continuously throughout the engine cycle. In addition to the continuous variation in load magnitude, there is also a continuous change in the direction in which the load is acting. At any given crank angle, a specific bearing load is applied radially to a specific portion of the bearing surface. This direction of load application is referred to as bearing load position. As an example, calculated load positions at several points in an engine cycle are shown in Figure 4.

The bearing load diagram shown is the same as in Figure 2 for high engine load and low engine speed. The load is applied to the bearing in the directions shown by the arrows at various crank angles. Thus, in addition to the continuous changes in bearing load, continual changes also occur in the bearing load position during each cycle. This motion in bearing load position has a pronounced effect on the bearing load carrying capacity of the oil film within the bearing.

This was described by J. M. Stone and A. F. Underwood in their paper "Load Carrying Capacity of Journal Bearings." Load carrying capacity can be defined as equal to the bearing load required to produce the minimum oil film thickness which will prevent contact between the bearing and journal surfaces. The load carrying capacity depends on several factors including bearing and journal dimensions, viscosity of the lubricant, minimum oil film thickness to prevent wear, rate of journal rotation, and rate of change in bearing load position. Using bench test apparatus, Messrs. Stone and Underwood demonstrated that the effects of journal rotation and load motion could be expressed by the term $(2N_L - N_J)$, where N_L is the rate of change in bearing load position and N_J is the rate of rotation of the journal with respect to the bearing. Assuming that the other factors mentioned above remain constant and are represented by "K," load carrying capacity can be expressed by the equation:

Load Carrying Capacity $= K(2N_L - N_J)$

Their finding was extremely important because it showed that the rate

of change of bearing load position has a major effect on the hydrodynamic oil film and that the rate of rotation of the journal with respect to the bearing was not the only speed effect involved, as was generally believed.

Critical Speed Ratio. One of the more interesting conclusions that can be drawn is that if the load position happens to be moving in the same direction and at one-half the speed of journal rotation, the oil film has no load carrying capacity. This is commonly referred to as the "critical speed" ratio.

Calculations were made of the load carrying capacities under the conditions shown in Figures 2 and 3. Figures 5 and 6 show these same bearing load diagrams with the load carrying capacity curves superimposed. In these cases the load carrying capacities were determined by assuming a value for "K," the constant term in the load carrying capacity equation. This assumption was necessary due to the difficulty in assigning exact values for the viscosity of the lubricant in the bearing and the minimum oil film thickness to prevent wear. These curves therefore do not show exact values, but they do demonstrate the pattern of load carrying capacity. It is shown that the load carrying capacity varies over a wide range and in fact equals zero several times during an engine cycle. These curves define the positions where the bearing load will probably exceed the load carrying capacity of the oil film. The shaded areas denote these positions, and these are the portions of the cycle during which wear is likely to occur. Further, the size of the shaded areas indicates the relative severity of wear.

Comparison of Figures 5 and 6 shows that a larger amount of wear would be expected to occur during the high speed, low load operating conditions shown in Figure 6, because the shaded areas are three to four times as large as those in Figure 5. This same relationship would hold regardless of the value assumed for "K." The operating conditions for which these curves were calculated were selected to give equal maximum bearing load.

What Tests Showed. The authors conducted engine tests using the radioactive tracer wear technique to investigate this point. The results in Figure 7 show that a considerably higher wear rate did occur under low engine load-high speed conditions than under high engine load-low speed conditions for given values of maximum bearing load. The observed differences in wear agreed with the calculated differences in wear, as shown by the relative amounts of shaded areas in Figures 5 and 6, thus lending further support to the findings made by Stone and Underwood. It can also be concluded from Figure 7 that bearing wear is a function of both the magnitude and source of maximum bearing load.

Figure 8 is an idealized chart showing the effects of changes in engine load and speed on bearing wear. Starting wear is defined as the wear occurring during start and warmup until an equilibrium wear rate is established. Starting wear after several hours of engine shutdown is in the same order of magnitude as the wear caused by the extreme high speed operation and is observed for as long as one hour of operation. The starting wear is significantly less, however, when the engine has been inoperative for only 10 to 20 minutes, probably due to the lower viscosity of the comparatively warm oil and perhaps residual oil in the bearing clearance space. Both factors promote faster establishment of a load-supporting oil film and tend to reduce roughening

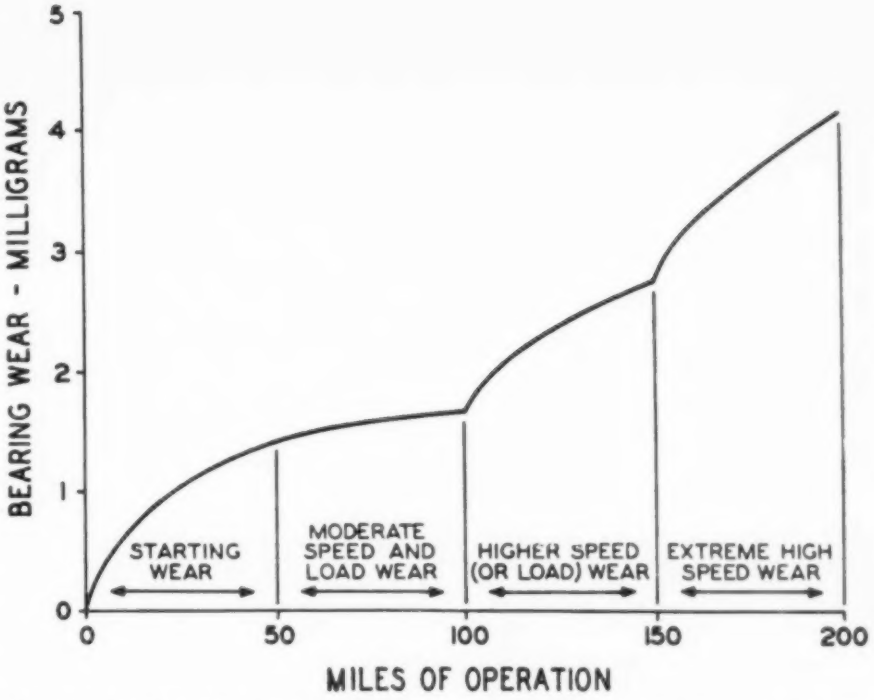


FIGURE 8—This idealized chart shows effects of changes in engine load and speed on bearing wear.

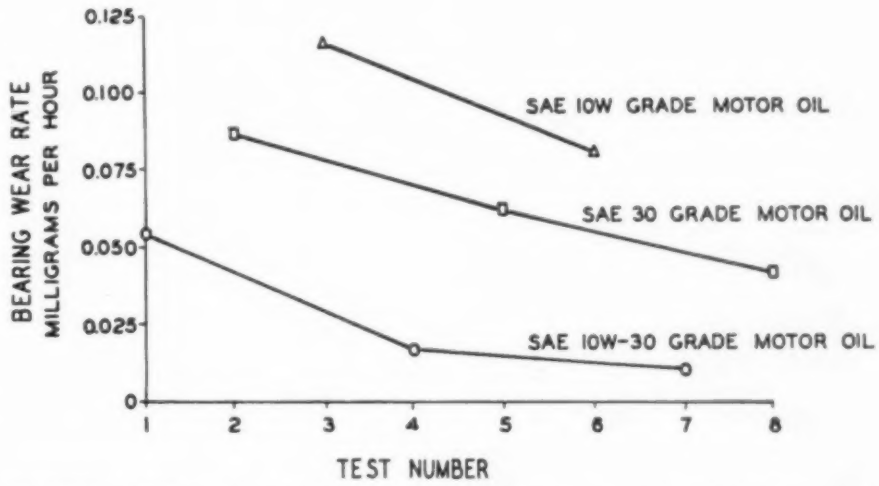


FIGURE 9—Effect of oil viscosity on bearing wear; low engine load, low engine speed, 10 bhp, 2500 rpm; test length, 300 miles; oil temperature, 195° F.

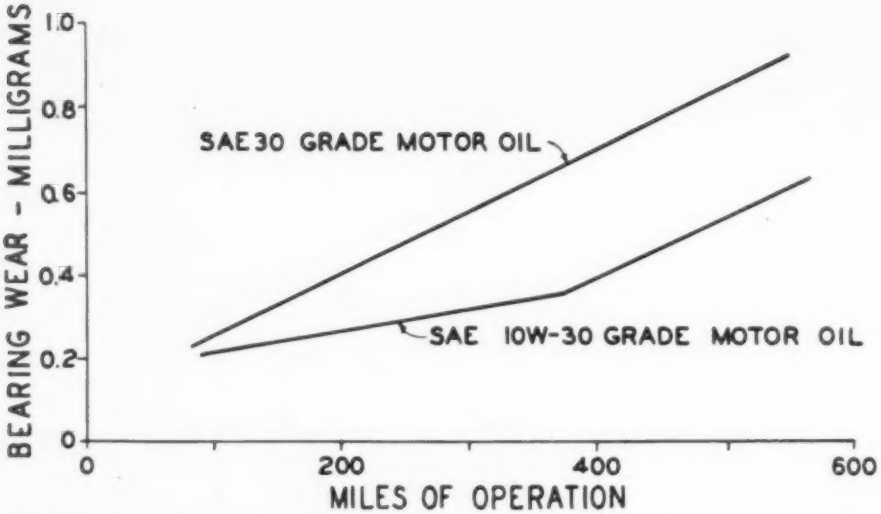


FIGURE 10—Effect of oil performance; low engine load, low engine speed, 10 bhp, 2500 rpm, 195° F. oil temperature.

When, Where, Who? Handy Index Tells All

Do you need to know when and where a certain article appeared in PIPE LINE INDUSTRY? The 1957 Editorial Index provides a time-saving entry into all 12 issues published last year.

Indexed by subject and by author, it is bound in handy pamphlet form for easy accessibility. To get your copy, write Librarian, Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas. Or, if you prefer, check the square provided on the blue Reader's Service Card at the back of this and every issue of PIPE LINE INDUSTRY.

The supply is limited, so a quick order will assure you of getting a copy.

of the bearing during engine startup. These results indicate that starting wear is due to break-in of contact areas which become roughened during each engine startup.

Changing engine load or speed after an equilibrium wear rate has been established causes an initial "jump" in wear followed by a gradual return to a steady wear rate. This is believed due to a shift in the positions where the bearing load exceeds the load carrying capacity of the oil film, and a break-in of the new contact areas takes place before an equilibrium wear rate is established.

Connecting rod bearing wear should be inversely proportional to a lubricant's viscosity according to the hydrodynamic load carrying capacity theory. The performance of oils over a range of viscosities is illustrated in Figure 9. The wear results of a series of eight tests conducted with three oils are plotted against the test number.

These data show that engine usage significantly affects the bearing wear performance of oils, and satisfactory comparisons between oils can be made only on a relative basis. Although the wear rate for any given oil decreased in this series of tests, sufficient data have not been obtained to conclude that bearing wear generally decreases with engine usage. These tests were conducted shortly after installation of a new bearing, and the mating surfaces were probably still wearing in.

Oils Compared. Figure 9 also shows that the SAE 30 grade motor oil protects against wear better than the SAE 10W grade motor oil. These data support the load carrying capacity theory, because the 30 grade oil is more viscous than the 10W grade oil.

The SAE 10W-30 grade motor oil inhibited wear significantly better than the 30 grade oil, although the measured viscosities of the two oils are very similar at the 195° F. gallery oil temperature. The effective viscosity of the 10W-30 oil in the bearing is not known. The temperature rise in the bearing would tend to give a higher relative viscosity for the multigrade oil, but, on the other hand, the high shear rate in the bearing would tend to result in a lower effective viscosity for the V.I. improved oil. In any event, the observed differences in wear appear considerably larger than can be explained by simple viscosity effects. Whatever the inhibiting mechanism, five SAE 10W-30 grade oils, each containing a different type of V.I. improver, have exhibited similar performance relative to an SAE 30 grade oil.

The wear rates shown in Figure 9 were observed in tests corresponding to 300 miles of operation. Actually, all of the tests were run for about 550 miles. Figure 10 shows typical results of a series of extended tests with the 10W-30 grade oil and the SAE 30 grade oil. The wear measurements were adjusted to eliminate the effect of engine usage. A pronounced change in wear rate at about 400 miles of operation was exhibited by the multigraded oil. After this inflection, the wear rate was nearly identical with that shown by the 30 grade oil. The inflection in wear with the multigraded oil has been observed consistently but as yet has not been satisfactorily explained. The wear advantage of the 10W-30 oil is distinct, but extended oil change periods would reduce the percentage improvement.

REFERENCE

[1] "Analysis and Lubrication of Bearings," M. C. Shaw and E. F. Macks.

About the Authors

Savage Bowman

L. O. Bowman entered the U. S. Navy in 1943 as a fire controlman. In 1951 he graduated from Oregon State College and joined the staff of the California Research Corporation. Bowman has been engaged in the fundamental aspects of engine lubricating oil research, including studies of bearing lubrication.

M. W. Savage joined California Research Corporation as a research engineer in 1946 and is now a group supervisor whose main assignment is the study of additives for engine lubricating oils. After graduating from the University of California in 1936, he worked as a research chemist in the field of petroleum chemistry from 1940 to 1946. During that time he engaged in research on drilling mud chemicals, catalysts for manufacture of aviation gasoline and lubricating oil additives.

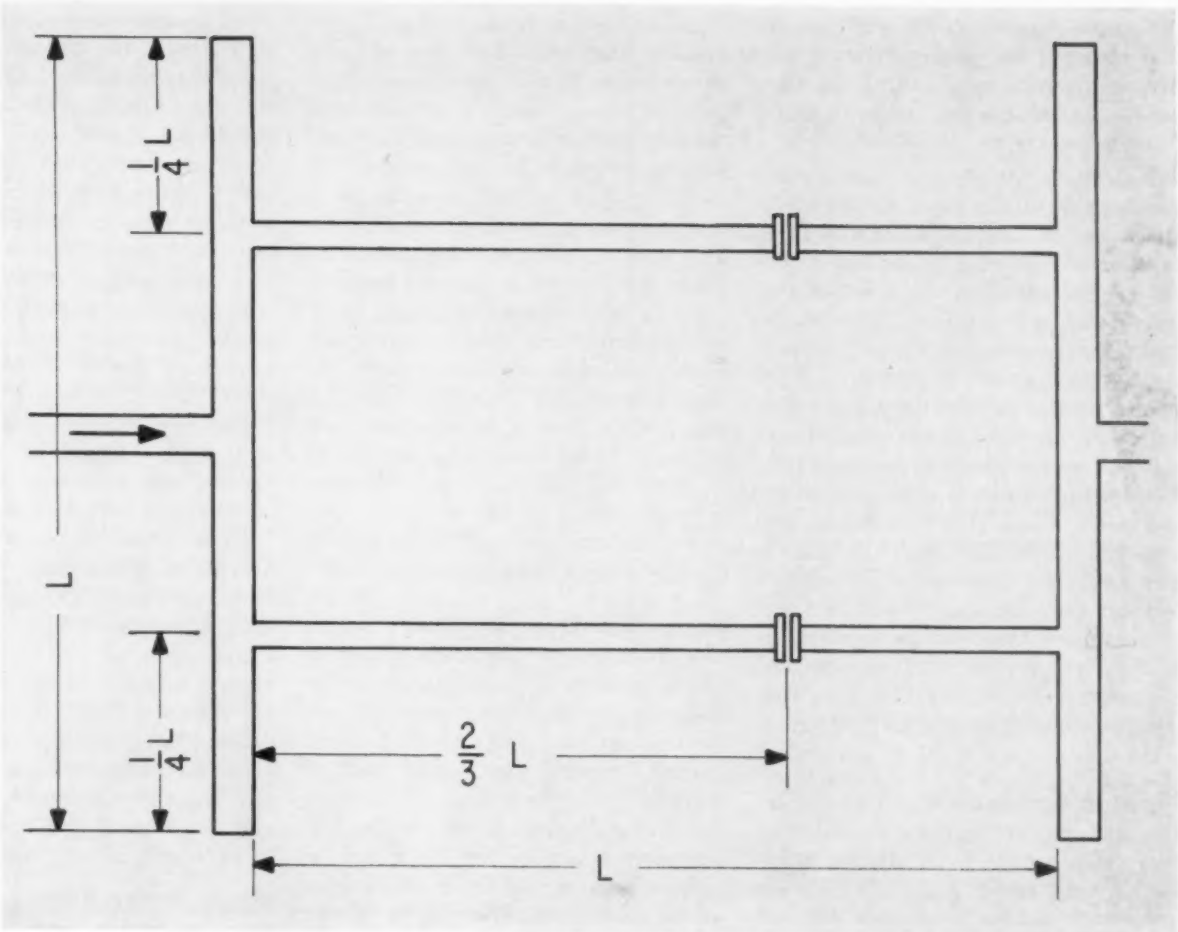


FIGURE 1—Proportions of an orifice meter setting to minimize resonant effects from pulsations.

Pulsations and gas measurement

Errors in orifice meter readings can be caused by pulsations in gas pressure. Proper design of meter runs can minimize this error.

By Howard S. Bean
National Bureau of Standards
Washington, D.C.

SINCE THE early days of fuel gas metering with any form of differential pressure meter—Pitot tube, venturi tube or square-edged orifice—the measurement engineer has been concerned with pulsation.

Pulsation implies the presence of more or less rapid variations of the pressure exerted by the fluid stream. This variation in the pressure may be accompanied by variations in the velocity or bulk flow of the fluid. It is possible for a body of fluid to be subject to pulsations, i.e. pressure variations without any real velocity or bulk movement of the stream taking place —as in a closed-end pipe. On the other hand one cannot visualize a fluid stream being subject to short time periodic velocity changes without being subject to similar pressure changes. A short time periodic change may be defined as one taking place or repeating every two to four minutes or less, usually very much less.

Rapid Pressure Changes. The rate of flow is determined from the measurement of a pressure difference, and it is the square root of the pressure difference that is the quantity used. As Lindahl stated in 1945, the measurement of the flow will be reliable if the means for measuring the

differential pressure are such as to make possible the determination of the average of the square roots of the successive differential pressures from instant to instant.

Unfortunately none of the instruments used in the past, and possibly few if any of those available today are capable of following accurately rapid changes of pressure. As a result the instrument will tend to indicate an approximate time average of the high and low values of the pressure. The square root of this time average value will be higher than the average of the square roots of the instantaneous differential pressures if such could be measured. Lindahl shows for a few very simple pressure patterns how it is possible to compute a theoretical relation between the "true" average of the square roots and the square root of the average differential pressure. It is necessary to assume that the true instantaneous pressures are measured accurately.

Type of Instruments Used. In considering the instruments used to measure pressures, especially the types used extensively in natural gas measurements, probably the majority are a form of mercury U-tube manometer. There will be a resonant or natural frequency at which the mercury in such a gage will vibrate or swing freely. This frequency will depend among other things upon the quantity of mercury and the shape of the gage chamber.

Also, there will be the influence of any float that may rest upon the mercury in one side of the gage. If there is imposed upon one side of such a gage a cyclic pressure influence having a frequency at or close to this natural frequency, the mercury may be caused to swing violently.

Gas Resonant Frequency. In between the main pipe and pressure gage there will be the pressure lines. Like the mercury, the body of gas in these lines will have a natural resonance frequency. In the transmission of a cyclic pressure from the main pipe to the gage, there is the chance that the frequency of this cyclic pressure will correspond closely to this resonant frequency of the gas in the pressure lines. In this case the intensity, that is amplitude of the transmitted pressure cycle might be even greater than that received, which would probably be an exceptional condition.

On the other hand fittings in the pressure lines, such as elbows, tees and valves, even if wide open, will act as pressure wave reflecting surfaces to a possibly greater extent than as transmission channels. Because of this it is probable that in the presence of a cyclic pressure, lines to the (recording) gage act as snubbers or retarders. This does not mean that the pressure received and shown by the gage is any nearer the true time average value of the cyclic pressure in the main line than if there were no intervening piping. Even if it were, there would still be the error introduced by the difference between square root of the time average value, which the gage will show, and the average of the square roots of the instantaneous pressures.

Theoretical Error Studied. Reference is made to Lindahl's paper in which he gives the mathematical relations representing the theoretical error in fluid metering due to the difference between the square root of the time average pressure and the average of the square roots of the instantaneous pressures for three simple types of wave form. Others have presented mathematical analyses of the response and behavior or pressure gages for both static and differential pressures, usually for the assumed idealized condition of having the cyclic presssure applied directly to the pressure responsive element.

A few analysts have attempted a mathematical treatment of a complete orifice meter system; the main line with a cyclic pressure wave imposed upon the base pressure, the orifice plate, the pressure leads and recording pressure gage. Most, if not all, of these have given up the attempt because the number of variables become too large to handle conveniently, or if a relation were developed it would have slight useful value. It is partly for this reason that these mathematical relations are included in this article.

High Frequency Variation. One of the first to study the problem presented by a pulsating flow was the late Prof. Horace Judd. He concluded the best solution is to suppress the pulsation, that is the cyclic pressure wave. This is still probably the most frequently offered recommendation, and the most frequently suggested procedure of accomplishing this is by introducing a sudden pressure drop, as with a valve or even an auxiliary orifice. No criterion is known by which to estimate the amount of pressure drop that might be "just enough." It has been said that the pressure drop should equal half the initial pressure. In other words, it should be a "critical" pressure drop which would result in a jet velocity immediately at the restriction outlet equal to the velocity of sound. Such a drop will certainly wipe out all low frequency, high amplitude pressure waves that might have been present in the stream initially. However such a high velocity jet is accompanied by or produces a very high shriek. This means it sets up very high frequency pressure waves of probably very low amplitude.

Reports are current of errors in orifice meter indications being traced to such high frequency pressure waves, that is waves of a frequency in the higher part of the audible range. Hence, it is not certain that the critical pressure drop method is without drawbacks. Certainly such a pressure drop would be economically prohibitive in a transmission line. Indeed, even an extra 5 to 10 psi drop would be decidedly unwelcome.

Meter Error Reduced. Largely from the work in the late 1930s by Beitler and Overbeck, it appears that with an orifice meter the error due to pulsation may be reduced by:

(a) Operating at as high a differential pressure as possible; and

(b) Using as large a β ratio as possible.

However, one of these should not be done at the expense of the other. In other words, in order to get a higher differential don't put in a smaller orifice and thereby decrease the β ratio. Put in a meter run small enough so that either, or better both, the differential and the β ratio may be increased. Where there are two or more meter runs in a station there would be several ways of achieving one or both of these objectives.

It was from this same work that the Beitler-Overbeck pulsometer was developed. With this instrument it is possible to obtain an estimate of whether the effects of pulsations at a meter location are likely to cause an error greater than or less than 1 percent.

Displacement Meter Limited. For situations where avoidable pressure losses must be kept to a minimum, some have made the suggestion of

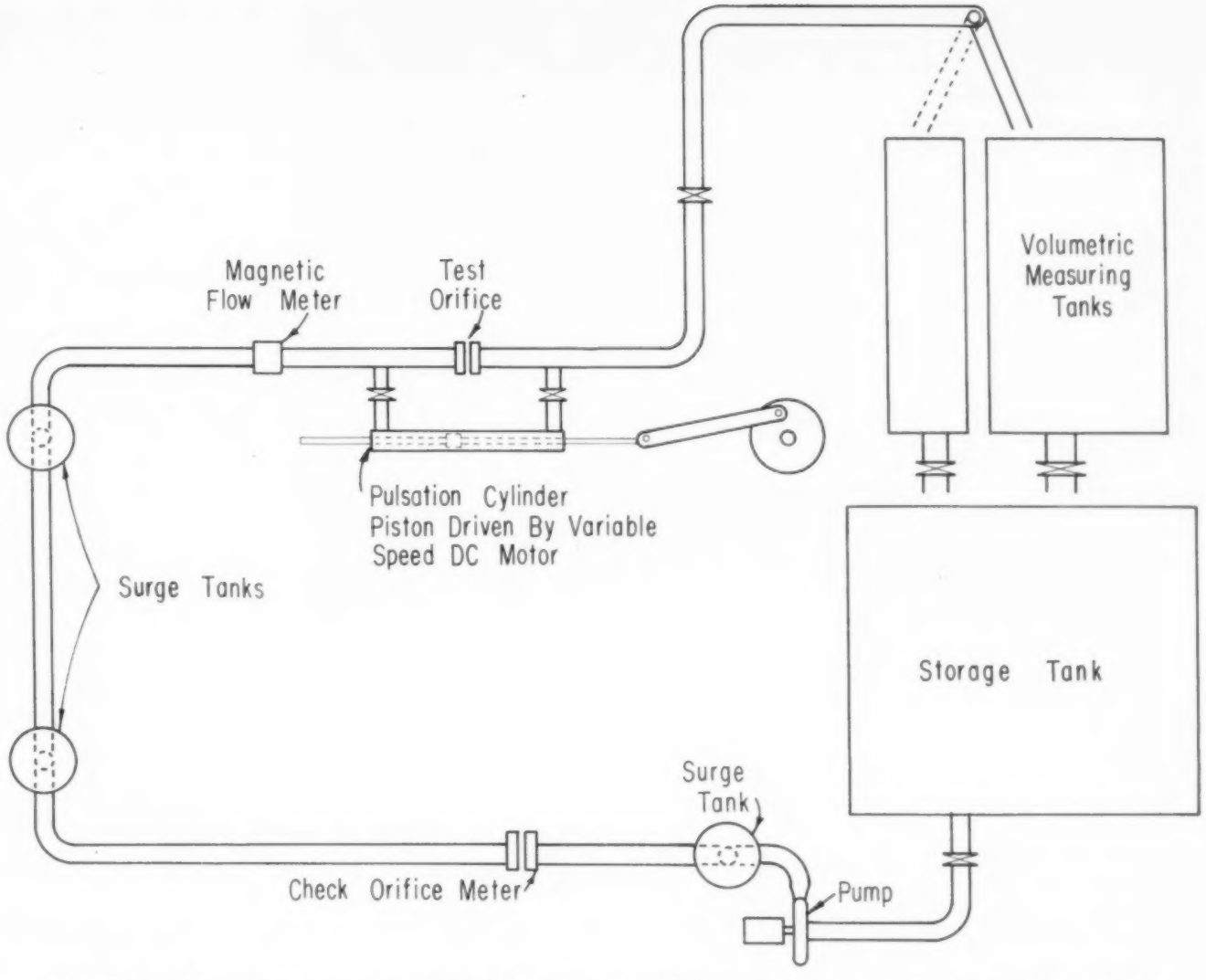


FIGURE 2—Schematic arrangement of water facility test line, pulsation research program, Southwest Research Institute.

using another type of meter, particularly a displacement meter. This is not too helpful, except possibly in situations involving small lines (about four inches and smaller) and at relatively low pressures. Suppose a diaphragm meter is considered. There have been reports of such a meter operating when subjected to a pulsating line pressure even when its outlet was closed.

Now suppose in this case the pulsation situation, that is the frequency and amplitude of the cyclic pressure doesn't change and flow is started through the meter. Tests are not available which would show whether the meter would over register or not, but it might. Again, suppose a rotary impeller meter is needed. Due to the large mass of its impellers such a meter would probably be unaffected by a pulsating condition, in general. There is the remote possibility that the frequency of the pressure wave would coincide with four times the rps of the meter rotors. If the impeller close-off coincided with a crest of a pressure wave the result obtained from the meter would be too low; if the close-off coincided with a pressure wave trough, the meter result would be high. To be sure the high or low error might be insignificant.

Other types of meters available are the so-called mass-flow meters, turbine type meters, and constant-head variable area (float) type meters. It is doubtful that any of them (except possibly the last), would be affected appreciably by a pulsation condition. However none of these is used in the fuel gas industry to a sufficient degree to justify further consideration of them.

A.G.A. Sponsors Research. Studies on pulsation now under way at the Southwest Research Institute, have called attention to the possibility of taking into account some long and well known principles about wave motion and acoustics in the design of orifice meter measurement stations. For instance, when a pressure wave or a light wave strikes a wall that is normal to its path, it is reflected back along its path with very little dispersion at 90 degrees to this path. Also, if the fluid in a pipe closed at both ends is caused to pulsate at its resonant frequency there will be nodes at the one-fourth point from each end. If then L (see Figure 1) represents the full length of the meter tube, both inlet and outlet sections, we should use inlet and outlet headers of the same length. The inlet and outlet to these headers should be at the center points and a meter run should be connected at the one-fourth points from the header ends. Finally the orifice plate should be located at the two-thirds L point from the inlet header.

Under the sponsorship of the Amer-

ican Gas Association, the pulsation research program at the Southwest Research Institute, originally was to be divided into three phases or tasks. Task 1 was a survey of the literature and patents pertaining to pulsating flows. This has been done, and Technical Report No. 3, Literature and Patents Survey on Orifice Metering of Pulsating Gas Flow is available from the American Gas Association. This is a very complete bibliography on this subject.

Acoustical Theories Applied. Task 2 was to develop a theoretical analysis based on acoustical and wave theories as applicable, and taking account of the effects of orifice plates, pipe fittings, gage lines, secondary elements (e.g. the recording pressure gages) and other parts subject to pulsating conditions. Under this task there has been prepared the paper "Analysis of the Effect of Pulsations on the Response of Mercurial Type Differential Pressure Recorders" by Martin and Moseley. Aside from preparing this paper, further work on Task 2 was discontinued as it appeared futile.

Reduction to Practice. Task 3 was to include such experimental work as agreed upon, and later the application to some actual field situations of any results developed. For the initial experimental work there has been set up a three-inch orifice meter test line as shown schematically in Figure 2. In these tests water is the test fluid. Later, with necessary modifications, and possibly at a different location, tests will be made with air, gas or steam as the test fluid. The pulsation chamber can be connected to operate against the inlet side, the outlet side, or both sides of the test orifice.

There are two sizes of pulsation chambers available. The length of stroke of the pulsation champer piston can be varied from zero to about 8″ thereby varying the amplitude of the pulsations. Also, by controlling the speed of the piston-driving motor, the frequency of the pulsations can be varied up to about 20 cycles per second. The absolute or net rate of flow through the system can be determined by timing the rate of filling one of the calibrated volume tanks. At the test orifice there is connected a conventional type mercurial differential gage to one pair of pressure taps. To another pair of taps (both sets are flange taps) strain gage type pressure pickups are attached and the outputs from these are fed to a Brush recorder.

Empirical Relations Sought. Early trials have shown that if a definite steady flow is established giving a certain reading on the mercurial differential gage with no pulsations, then as either the frequency or amplitude of pulsations, produced with the pulsator chamber, are increased, the differential pressure shown by the mercurial gage increases, and may go beyond the chart range. From further work it is expected to develop empirical relations betwen such quantities as the amplitude and frequency of the pulsations and either the steady flow differential or the observed differential as shown by the mercurial gage or determined from the strain gage pickups.

The committee supervising this program will strive to get any useful results, that may be definitely established, into the hands of the gas industry as quickly as possible. But do not expect sweeping solutions of the pulsation problem right away. It will take time—maybe several years.

BIBLIOGRAPHY

Effects of pulsations on Flow of Gases, H. Judd and D. B. Pheley; Transactions, ASME, volume 44, 1922, page 853.

Pulsation and Its Effect on Flow Meters, E. J. Lindahl; Transactions, ASME, volume 68-8, November 1946, page 883.

Basic Difficulties in Pulsating-Flow Metering, A. R. Deschere; Transactions, ASME, volume 74, 1952, page 919.

Orifice and Flow Coefficients in Pulsating Flow, N. A. Hall; Transactions, ASME, volume 74, 1952, page 925.

Literature and Patent Survey, Orifice Metering of Pulsating Flow, D. S. Moseley, and A.G.A. publication, April 1956.

Pulsation Errors in Manometer Gages, T. J. Williams; Transactions, ASME, volume 78-7, October 1956, page 1461.

Analysis of the Effect of Pulsations on the Response of Mercurial Type Differential Pressure Recorders, R. J. Martin and D. S. Moseley, presented at ASME annual meeting 1957.

A Practical Pulsation Threshold for Flowmeters, V. P. Head; Transactions, ASME, Vol. 78, Oct. 1956, P. 1471.

ACKNOWLEDGMENT

The author wishes to thank the sponsors of the Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va., for releasing publication rights of this article to PIPELINE INDUSTRY.

ADDENDA

To illustrate the difference between the square root of the average differential and the average of the square roots, assume a "square" wave form where the

minimum differential = 25″ and the maximum differential = 49″

Obviously the *average* differential is 37″ and $\sqrt{37} = 6.0828$

However $\sqrt{25} = 5.00$

and of $\sqrt{49} = 7.00$, so that the

average of the square roots is 6.000

Thus the ratio of the square root of the average differential to the average square root is 1.0138, or about 1.4% the larger.

In a recent paper (October 1956, Transactions) Victor Head proposes the use of a "pulsation factor" which he defines as

$$f_p = \frac{q_i}{\bar{q}}$$

where q_i is the indicated average flow, and $\bar{q}$ is the actual average flow.

If in our example we *assume* that the square root of the average differential represents the indicated rate, and the actual rate is represented by the average square root then under this assumption the Victor Head pulsation factor for our example would be

$$f_p = 1.0138$$

There are two ratios that are used more or less frequently in connection with pulsating flow. The first of these is called the HODGSON number, which he gave in this form

$$N_H = \frac{CFL}{GZ}$$

where C = capacity of the pipe line between the meter and the source of pulsation
F = the frequency of pulsation or the frequency with which the wave-form of the flow-time curve repeats itself
L = *loss* of pressure across the orifice meter or across the orifice meter and a throttling orifice placed in series and fairly close together
G = the mean weight flow
Z = $v_e = p_e$ where
v_e = specific volume of the fluid in the capacity C at the mean temperature and pressure therein
p_e = the absolute pressure in C, i.e. the time average absolute pressure

Chilton and Oppenheim have written the Hodgson number in substantially the form

$$N_H = \frac{Vf}{w} \quad \frac{\bar{p}_l}{\bar{v}\,\bar{p}}$$

where V is the volume of a receiver between the orifice meter and source of pulsation
f is the frequency of the pulsations
p_o is the instantaneous pressure at the meter inlet
p the instantaneous pressure in the receiver
while $\bar{p}_o$ and $\bar{p}$ are time average values
$\bar{p}_l$ is the time average pressure loss across the meter and any piping between the meter and receiver
$\bar{w}$ is the time average rate of flow (weight units)
$\bar{v}$ the time average specific volume of the fluid in the receiver

The second number, or ratio is called the STROUHAL number and is

$$N_s = Df/\bar{V}$$

where D is a diameter, it may be either the pipe diameter or the orifice diameter (usually we would use the orifice diameter)

f is the pulsation frequency

$\bar{V}$ the time-average velocity of the fluid across the section to which D applies

The End

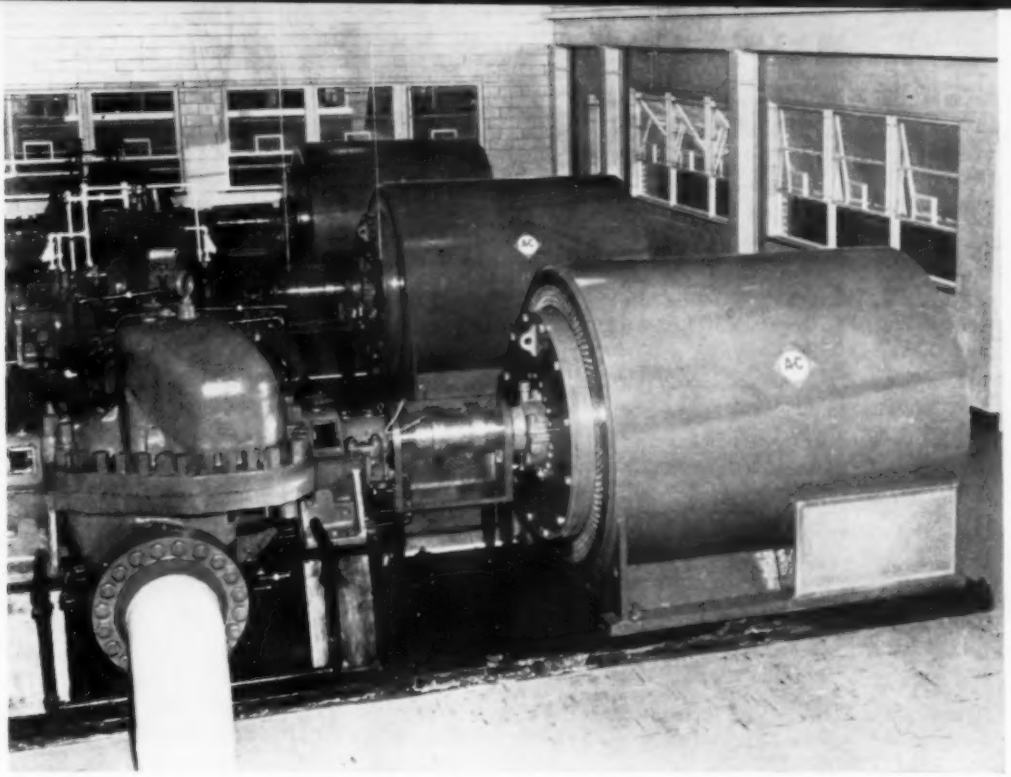


FIGURE 1—Motors coupled to pipe line pumps are one of many applications where the limited end float features are incorporated into flexible couplings. These tube-cooled, 1200-hp, 1780-rpm motors are installed in a main line pump station.

Limited end float couplings . . .

Prevent excessive axial thrust on pump

Good practice for most horizontal sleeve bearing motors requires flexible couplings with limited end float.

By E. B. Mills and John E. Petermann
Allis-Chalmers Mfg. Company, Milwaukee

AN IMPORTANT consideration in the successful application of sleeve bearing electric motors is the selection of a flexible coupling to transmit torque from the drive motor shaft to the driven unit. Various types of couplings are available; however, certain precautions must be observed in applying some types to avoid bearing damage. In some instances, motor bearing damage may result from axial forces transmitted by the coupling back from the driven machine. A thrust bearing in the driven machine plus a limited end float coupling prevents this axial thrust from being transmitted to the drive motor shaft.

Axial Thrust a Problem. A limited end float coupling is defined as "a free-floating" type coupling in which the total relative axial movement of the hubs has been limited within the coupling itself to not more than one-half of the motor float. Although limited end float couplings are commonly considered new, they have given satisfactory service for over 25 years.

Unrestricted free-floating types of couplings, which include the pin and bushing type, the spring grid type, and the gear type, can present thrust problems. By adding a restraint to these couplings, they can be converted to limited end float type, as shown in Figure 2. Self-positioning types of couplings are considered free from thrust problems and do not require mechanical stops. The laminated metal disc type coupling is a familiar example of the self-positioning type.

Thrust Must Be Limited. In horizontal applications, such as pumps and compressors, driven machines as well as their drive motors have provision within their construction to po-

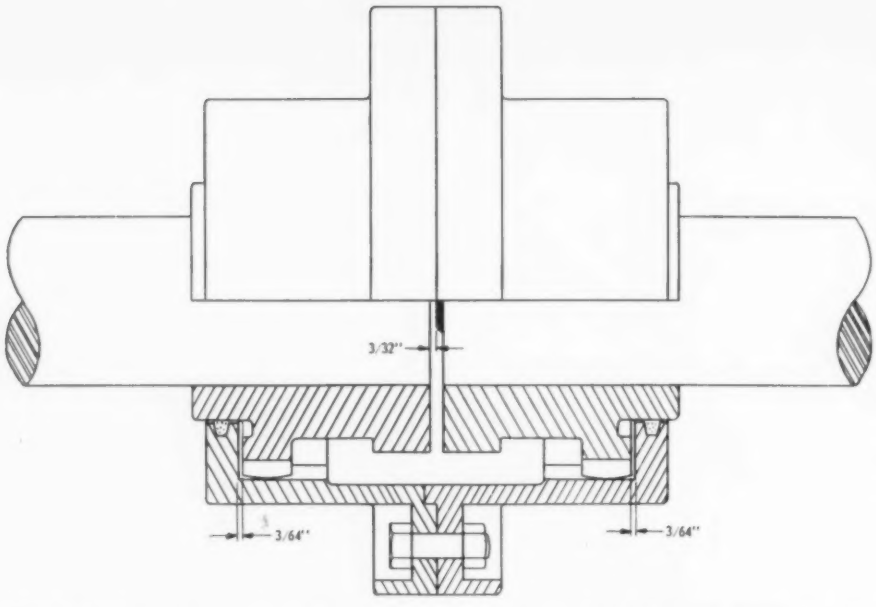


FIGURE 2—Small button on the end of one shaft serves to limit the float in one direction, while coupling separation is limited by lips on the coupling cover. Arrangement shown is for typical gear type coupling.

sition their own rotating element. A thrust bearing is normally used in driven equipment to restrain its thrust forces. End play of the pump or compressor is usually limited to a few thousandths of an inch, because of the close internal clearances that must be maintained.

Motor bearings, however, are designed to permit a relatively large rotor end play, or float, since the motor design does not impose restrictions requiring close axial clearances. One-half inch float is standard on larger machines. Furthermore, an electric motor develops a self-centering force which causes the rotor to run on magnetic center, and this force acts as a restoring force if the rotor is externally displaced from magnetic center. Of course, motors are assembled so the magnetic center is within the limits of float of the motor bearings, and the rotor of an uncoupled machine at rest may be anywhere within the allowable float limits.

Bearing Thrust Capacity Limited. Since the motor rotor is positioned or centered by magnetic forces during normal operation, there is no necessity for bearings designed to carry continuous thrust. There are several reasons, however, for providing some mechanical limitation on rotor float. First, it is necessary to prevent excessive axial travel of the rotor when the motor is de-energized and coasting to rest. And second, depending on the initial position of the rotor relative to magnetic center, forces may exist during starting which will cause the rotor to "overshoot" the magnetic center.

To limit rotor travel under either of the conditions, shaft shoulders are provided, and the end surfaces of bearing bushings are babbitted over the area which the shoulders contact. Since it is essential that oil leakage from the bearing into the motor be minimized, the babbitted end surfaces are not provided with positive lubrication and cannot withstand continuous thrust load.

Lubrication Protects Bearing. A typical standard motor bearing construction is shown in Figure 3. Nearly

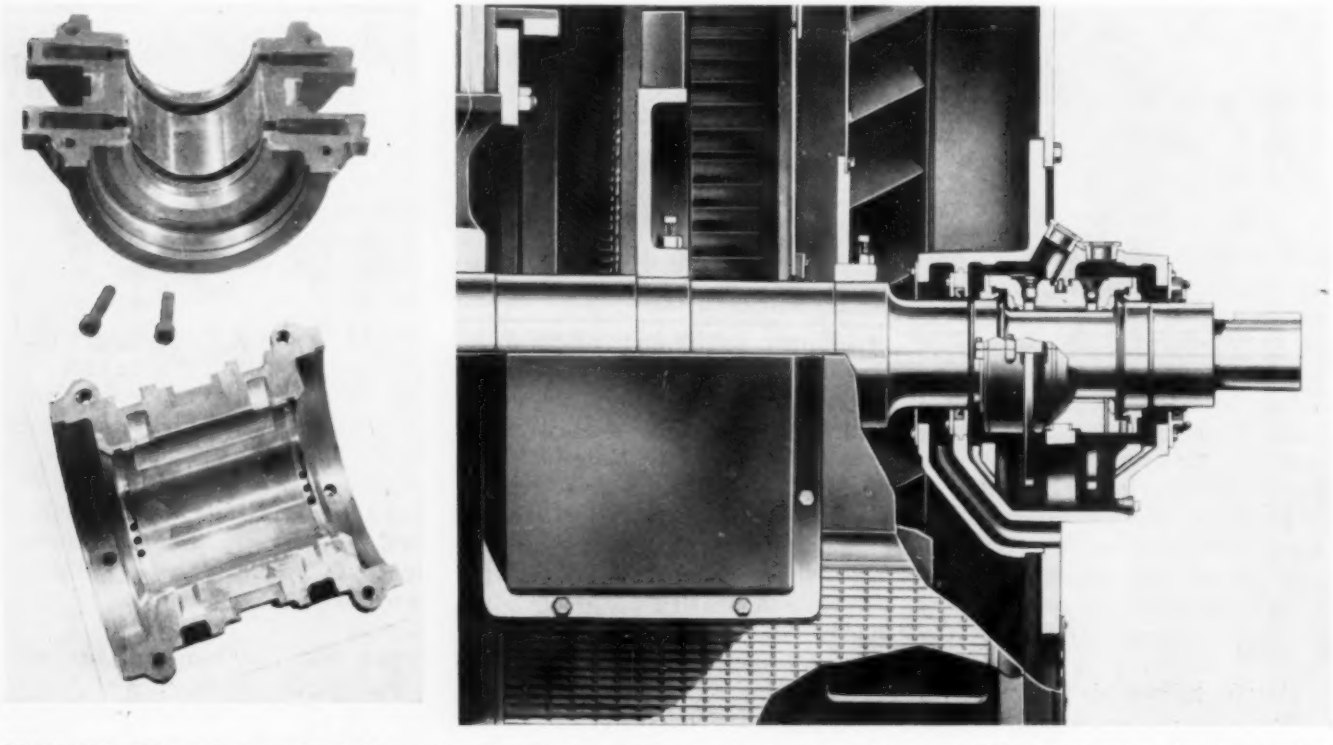


FIGURE 3—Thrust faces on the shaft at each end of the journal serve in conjunction with the babbitted ends of the bearing to limit motor float but are not intended to withstand a continuous axial thrust load.

all of the oil discharged from the bearing is collected in the annular grooves near the ends of the bushing, and is drained back into the bearing housing through holes in the bottom of this annular groove. This prevents oil from being sprayed and atomized by the shaft shoulders and thus provides a very effective oil seal. The small amount of oil that escapes to the ends of the bushing wets the surface and provides sufficient lubrication for momentary thrust on start-up or for positioning the rotor while coasting.

The effectiveness of this bearing design to withstand any motor-imposed thrust forces is continually being demonstrated in applications where the motor is free of externally imposed thrust forces. Solid-coupled motor generator sets, belted drive applications, and flexibly coupled drives with self-positioning type couplings are typical examples.

The concept that motor-developed thrusts must be carried externally because motor bearings are incapable of handling these thrusts is without basis.

Causes of Bearing Damage. There are several possible ways that damaging external thrust may be imposed on motor bearings through unlimited end float couplings. One of the most common is through misalignment of the coupling. Misalignment causes the coupling hubs to pull together, or to separate, thus imposing thrust on both the motor and driven equipment bearings.

Another common cause of trouble is coupling locking. When the motor rotor is coasting to rest, it is free to float within the limits of bearing end play, since there is no torque on the coupling at that time. The rotor may stop with the shaft shoulder in contact with the bearing shoulder, and upon starting, the rotor will be held in position by friction resulting from torque at the coupling. This locking of the coupling is more effective at starting because of the increased starting current which increases the torque into the coupling. With worn or improperly lubricated couplings the locking tendency becomes greater. This condition can result in the rotor remaining out of its magnetic center. The magnetic forces tending to restore the motor rotor to its central position are small in comparison to the frictional resistance of the coupling to slipping axially. With the coupling locked, thrust conditions may be further aggravated due to thermal expansion of the shafts, especially if the thrust bearing of the driven machine is located at the outboard or end opposite the coupling end of the unit.

Thus the fundamental difficulty with unlimited end float couplings is that they permit conditions wherein two thrust bearings are loaded in opposition to one another. The magnitude of the thrust load on the motor bearings and the driven machine is equal to the force required to slip the coupling. The driven machine thrust bearing must then carry this coupling-imposed thrust plus its own thrust load.

Thrust Reduced. With a limited end float coupling, the driven unit thrust bearing is subjected to no additional thrust unless the motor is being held off magnetic center. Even with the motor held off magnetic center the force is small—less than required to slip the couplings. Therefore, the driven unit thrust bearing is subject to less load with limited end float couplings than with unlimited end float couplings. Thus it is to the advantage of the driven equipment as well as the motor to use a limited end float coupling.

The problems with free-floating couplings have been considered by a joint committee of the Hydraulic Institute and the National Electrical Manufacturers Association. Recommendations on the use of limited end float couplings were adopted and are now included in NEMA Standards. These recommendations are reproduced in Table 1. Although specific reference is made to hydraulic pumps, the same principles are equally applicable on other types of drives.

TABLE 1—Taken from NEMA Standards MG1-6.11, Jan. 1957

Where motors are provided with sleeve bearings the motor bearings and limited end float coupling should be applied as indicated.

Motor Horsepower	Synchronous Speed of Motor, Rpm	Minimum Motor Rotor End Float, In.	Maximum Coupling End Float*, In.
125 to 200, incl.	3600 and 3000	1/4	3/32
250 to 450, incl.	1800 and below	1/4	3/32
250 to 450, incl.	3600 and 3000	1/2	3/16
500 and higher	All speeds	1/2	3/16

* Couplings with elastic axial centering forces are usually satisfactory without these precautions.

Variety of Couplings Available. Limited end float models of the various types of free-floating couplings are available from several coupling manufacturers. The means of limiting the float depends on the type of coupling.

Pin and bushing type couplings may be limited through the use of two special pins located at diametrically opposite positions. A spacer washer is mounted on each of these enlarged head pins.

The end float of spring grid-type couplings can be limited with spacer plates or buttons located between shaft ends in conjunction with half oval soft steel or copper inserts or "rung-spacers" placed in the loops of the springs. These rung-spacers are located symmetrically to maintain balance.

Gear-type couplings may be limited through the use of spacer plates or buttons, as shown in Figure 2. Hollow spacer-type couplings require plates at each end of the spacer. Thrust tending to bring the coupling halves together is restrained by the buttons. Thrust tending to separate the two halves of the coupling is restrained by lips located at the ends of the coupling cover.

Existing Couplings Can Be Limited. Although the above methods are preferred for limitation of end float in free-floating types of couplings, spacer plates or buttons may be omitted at the user's discretion. The end float of free-floating type couplings can then be limited by overpressing one or both coupling hubs to locate them farther back on the shaft, thus allowing the shaft ends to protrude slightly through the coupling hubs. With this

arrangement care must be exercised to get the hubs back in the same location should they be temporarily removed for maintenance or other reasons.

This latter means of limiting coupling end float is one which is generally readily adaptable on existing installations on which it is desired to incorporate the limited end float feature. No new or additional parts are required, since it can be accomplished simply by overpressing the coupling hub slightly and repositioning the motor slightly toward the driven machine.

Standard Alignment Methods Used. The alignment of a motor when using a limited end float coupling is simple and straightforward. It requires no more time, effort, or degree of accuracy than is needed to properly align machines using non-limited end float couplings. Figure 4, in conjunction with Table 2, shows a method of making proper setting of the motor in relation to the driven shaft. While the schematic arrangement is shown with the gear-type coupling, the arrangement also applies to pin and bushing and spring grid-type couplings. The coupling is shown in the closed position. Normal coupling operation may be fully closed, fully open or at some intermediate position.

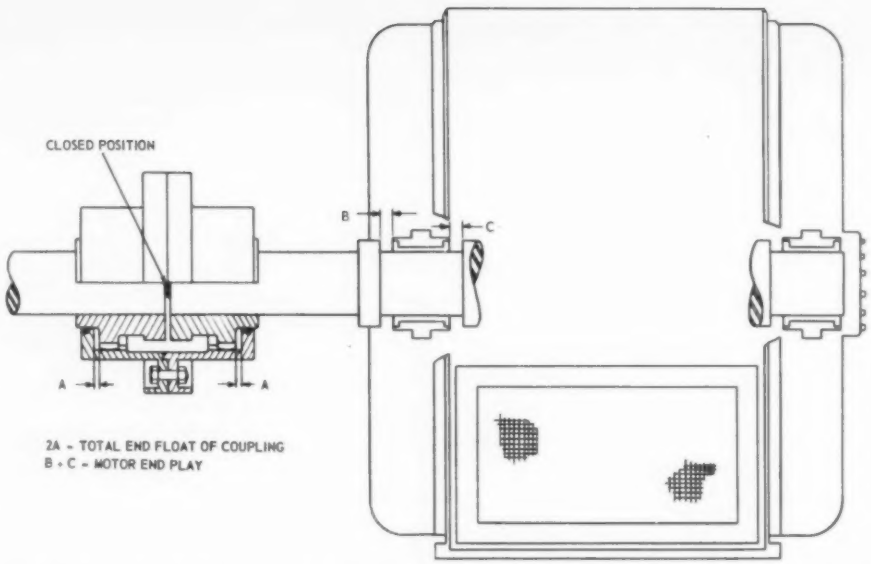


FIGURE 4—Shaft alignment of motors with limited end float couplings require the same care as with machines without this feature. Table 2 shows the correct relationship of motor bearing and coupling clearance for correct axial positioning.

While the dimensions in Table 2 are for nominal values of motor end play, motor end play has some tolerance and may vary slightly from the nominal value. An instruction plate on the motor gives data on the actual end play when a limited end float coupling is required. Any variation of the actual end play from nominal should be divided equally between dimensions A and B. When aligning machines having self-positioning type couplings, the motor must be located relative to the driven unit so that the motor shaft is in the center of its end float. Referring to Figure 4, B will equal C.

After positioning the motor to obtain the proper axial setting, an accurate shaft alignment must then be established. Alignment should be made so that the motor shaft and driven unit shaft are in line at normal operating temperatures. Compensation must be made for any temperature differential that exists between the units. To assure that the desired alignment has been achieved, a final "hot" alignment check is made immediately after shutdown from a prolonged run under normal operating conditions.

TABLE 2—Coupling and Bearing Settings
(Dimensions in Inches)

Nominal Motor End Play	Limited Coupling End Float	A	B	C
1/2	3/16	3/32	11/32	5/32
1/4	3/32	3/64	11/64	5/64

With motor half coupling located midway of total coupling end float, instead of closed coupling, make B = C.

Economy and Good Design Result. It has been pointed out that a motor, as an independent uncoupled machine, does not require a thrust bearing. The expense of providing a motor thrust bearing, which would be added to the motor cost, is an additional consideration. Since motor thrust bearings must be lubricated, they complicate the problem of keeping oil out of the motor itself. In addition, providing two thrust bearings in series, one on the driven unit and one on the motor, is generally considered to be poor mechanical design practice.

—The End

About the Authors

John E. Petermann E. B. Mills

John E. Petermann, a supervisory engineer in the induction machines group of Allis-Chalmers Motor and Generator department, has been with the company since 1940. A 1939 mechanical engineering graduate of Marquette University, Petermann has specialized in balancing and other vibration problems associated with large electrical machinery. He has authored a number of technical articles dealing with axial thrust and aligning problems in connection with electrical motors. He is a member of the Engineers' Society of Milwaukee and a registered professional engineer in the state of Wisconsin.

E. B. Mills, engineer-in-charge of induction machines in Allis-Chalmers Motor and Generator department, joined the company in 1942 after receiving his mechanical engineering degree from Kansas State College. During World War II he served as a gunnery officer and subsequently executive officer of an LST in the Pacific. At Allis-Chalmers he has been associated with the design and tests of explosion-proof motors and the development of inert gas filled motors. Mills is a registered professional engineer in the state of Wisconsin and a member of the American Society of Mechanical Engineers.

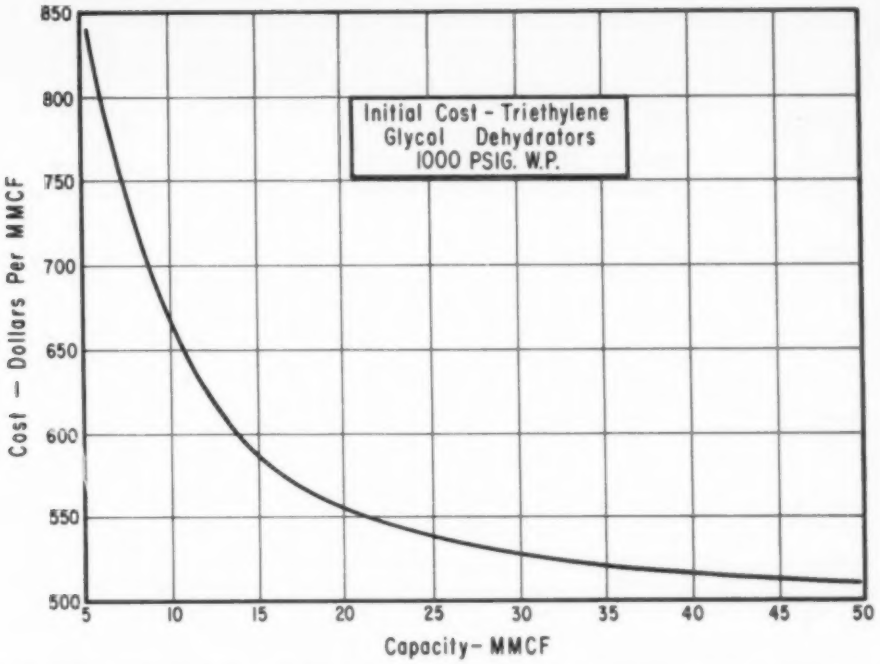


FIGURE 1—Initial cost of 1000 psig working pressure triethylene glycol dehydrators per million cubic feet of capacity.

Economical operation of glycol dehydration units

Various types of glycol dehydration units are available. Which type will be most satisfactory for your installation?

Warren Richardson
Black, Sivalls and Bryson, Inc.
Oklahoma City

WELLHEAD type glycol dehydration versus plant type glycol dehydration has been a subject of debate in recent years. Both systems have been tried and proven satisfactory. No one method is the best answer to all problems. Circumstances must be surveyed to arrive at a satisfactory method of dehydration for the individual problems. Factors that must be taken into consideration when considering such an installation are:

- Equipment costs
- Type of production, pressure and locality
- Value of continuous pipe line operations
- Final dewpoint expectations
- Operating cost and maintenance

Four Systems Available. Basically, there are four types of glycol dehydration systems. The first is complete wellhead dehydration where the dehydrator is at the wellhead and giving dewpoints sufficiently low to meet pipe line specifications.

Second is a centralized field dehydration plant where the dehydrators are set at strategic points to collect the production from several wells. These will give pipe line specification gas but do not protect the gathering system.

Third is the mainline plant where

TABLE 1—Minimum Ground Temperatures

AREA	Tg 18 In. Cover	Tg 36 In. Cover
Rocky Mountain	25 F	30 F*
Midwest	30 F	35 F*
Oklahoma and Texas Panhandle	35 F	40 F*
East, Central and West Texas	45 F	45 F
Gulf Coast	50 F	50 F

* Add 5 F for each additional foot of cover, up to where the total depth does not exceed 6 ft.

no protection is given to the gathering system.

The fourth is a combination of wellhead and mainline plants. The wellhead unit is a less efficient unit, probably two trays giving less dewpoint depression (50° to 55° F.) but sufficient to protect the gathering system, which can be followed by a pipe line unit for final dehydration to meet the pipe line specifications.

Cost First Consideration. First question mentioned in selecting a system is the cost of equipment. Figure 1 shows that the cost of dehydration per million cubic feet decreases as the size increases. For any size wellhead or centralized unit the cost per million remains constant for that particular size. From this it can be concluded that multiple units will represent a higher initial cost than one large pipe line dehydrator. The less efficient unit giving 50° to 55° dewpoint depressions would fall somewhat below the same point on the curve for any given size when taken from the chart. Economy is a very important factor but in some cases can be waived in favor of operating advantages.

The second consideration in selecting a system is the type of production. Figure 2 shows the point at which hydrates will begin to form for different gases. In general, the higher the operating pressure the higher the temperature at which the hydrates will form. Thus dehydration is more important in a high pressure gathering system than for a low pressure system.

Table 1 shows the minimum ground temperature for the different sections of the country. Some methods and assumptions have been made to calculate the heat losses from the pipe line to the ground but soil conditions are so varied that these methods are sometimes not very reliable. It can also be shown that the gas travels but a short distance before reaching the ground temperature.

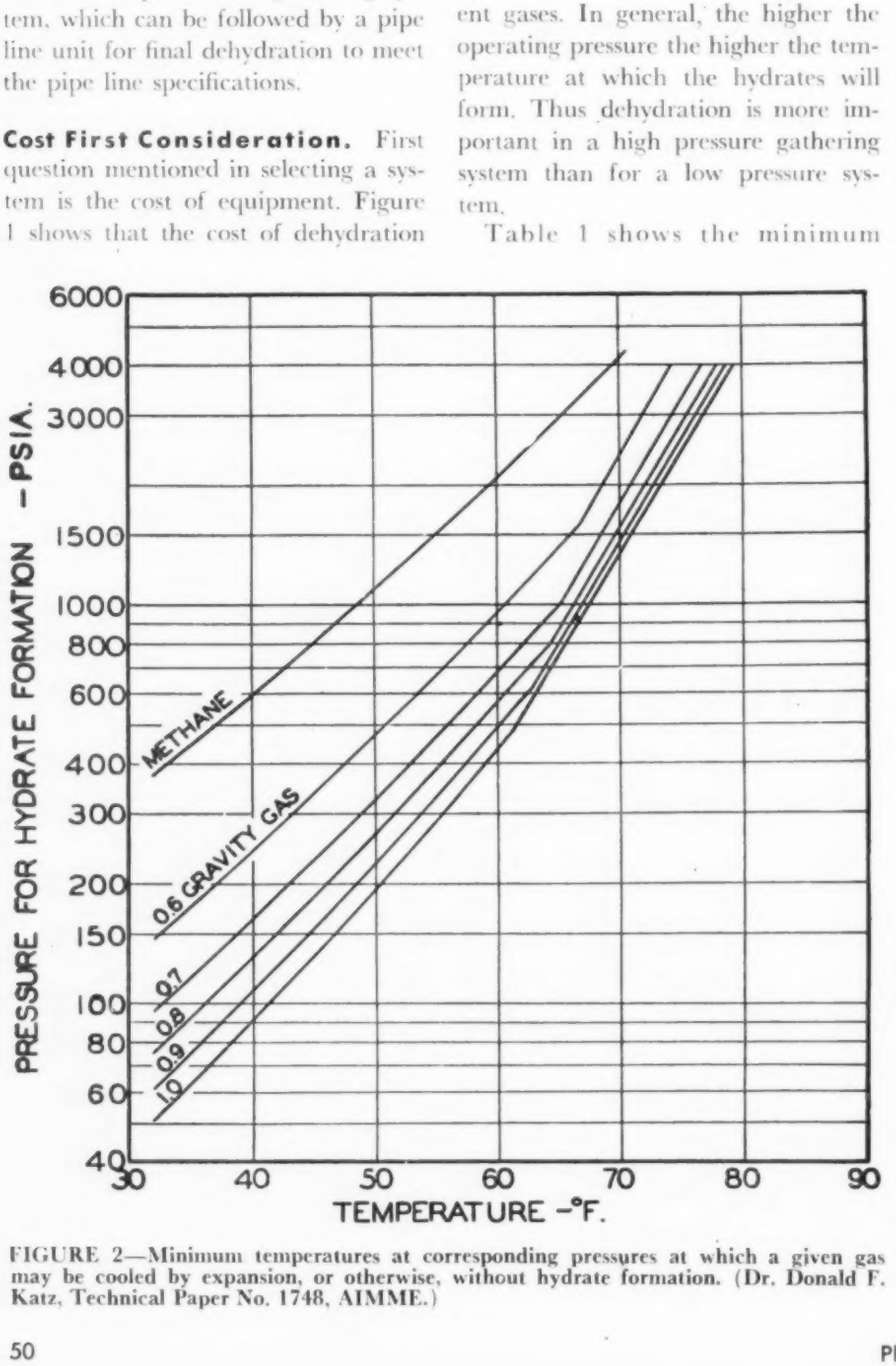


FIGURE 2—Minimum temperatures at corresponding pressures at which a given gas may be cooled by expansion, or otherwise, without hydrate formation. (Dr. Donald F. Katz, Technical Paper No. 1748, AIMME.)

Inhibiting Hydrates. Several methods have been used to prohibit the formation of hydrates until the gas reaches the given dehydration point. Some of these systems are:

- Methanol injection
- Glycol injection
- Heaters

Of these three systems the most prominent one is probably glycol injection, due to the fact that glycol can be reclaimed whereas methanol is lost. Heaters are relatively expensive in both initial and operating costs. Also there is the problem of optimum location of the heaters in order to combat the problem. Methanol injection and glycol injection are good for short time operation but if these have to be operated the year around it becomes quite expensive.

Liquid Hydrocarbons Problem. Besides the water and freezing conditions that exist, there is always a problem of liquid hydrocarbon in the lines. As the temperature is reduced, some hydrocarbons will pass from the vapor state to the liquid state if the system does not have a hydrocarbon dewpoint below the lowest temperature reached. If separation is made at 80° F. the gas is saturated with hydrocarbons at that temperature, so that when the gas is cooled to 60° F. by the ground temperature, liquid hydrocarbons will be present. In a gathering system, this is generally not important to pipe line efficiency since the lines are not operating at maximum conditions.

The problem that does exist in selecting a dehydration system is the surging of this fluid into the inlet separator to a unit. A separator must be selected with large liquid surge capacity.

Heaters Sometimes Required. Another problem that exists on pipe line or centralized units is the temperature

of the gas reaching the processing point. In the higher pressure gathering system it is common for the gas to be below the hydrate point and still flow without difficulty. This is possible for two reasons. (1) The flow line may be partially frozen but not enough to cause a pressure drop of any consequence since the pipe line is not operating at full capacity. (2) Hydrates may be forming but have not found a place to collect, therefore they are moving with the gas stream.

If this is happening upstream from a dehydrator installation, the hydrates will be collected in the separator portion of a unit and then liquid carryover will be witnessed in the dehydrator. This not only becomes an operating problem but also a fire hazard if the liquid carryover is sufficient to fill the reboiler and storage tank with hydrocarbon liquid. If this condition exists, then some means of heating the stream above the hydrate point becomes a necessity. This problem is more prevalent in centralized and mainline dehydrators. Well flowing temperatures are generally sufficient to eliminate this problem with wellhead dehydrators. However, some sections of Oklahoma are plagued with low flowing temperatures and freezing is witnessed in the tubing and casing. In these localities heating equipment must be installed.

Freeze-Ups Expensive. The third factor that must be taken into consideration is the importance of continuous pipe line operations. A dollar and cent sign cannot be placed on lost production. Since gas production is generally at its peak in cold weather and as this is a time when most freezing occurs, it is very difficult to determine what the actual cost of lost production might be. In any event, it is very expensive to thaw pipe line freeze-ups. It has been the common practice of some companies, when a line becomes frozen, to inject methanol into the line and backflow the line by decreasing the pressure on the upstream side of the hydrate block. This could be somewhat dangerous to both personnel and the pipe line itself, especially in the higher pressure systems.

Dewpoint Depression. The fourth consideration is the expected dewpoint. In most pipe line operations it is desirable to have seven pounds or less of water per million standard cubic feet of gas for pipe line operations. In some cases where there are extremely high temperatures or very low pressure it is impossible to obtain this with glycol dehydration.

Generally on lower pressure systems (such as the Hugoton field) freezing is not a big problem. If extremely high temperatures are encountered, then one must look at the economics of precooling. Cooling is generally considered a less expensive means of dehydration. As can be seen by the water content curve (Figure 3), the gas at 80° F. and 1000 pounds contains approximately 35 pounds of water per million cubic feet and at 130° and 1000 pounds it contains approximately three times as much water. Precooling would certainly reduce the operating costs of a dehydration plant.

Operating Cost Important. The fifth consideration is operating costs. Actual operating costs of each of these systems are not obtainable and probably would not be applicable to the individual companies, since the operating cost will vary from company to company for each type of unit. However, the glycol consumption will remain relatively constant for each type of operation since the loss is calculated on the gas throughput. The mechanical losses, such as spillage, will be higher on the multiple units than for one large central plant. Pumping and fuel costs will also be higher on multiple units, due to the efficiency of the pumps and reboiler.

The heat input to each gallon of glycol is constant and the circulation remains the same in each type of operation because there is a certain amount of water to take out and there has to be a certain amount of glycol circulated whether there is one big unit or multiple small units. Maintenance and manpower costs will be increased with the multiple units. On a large pipe line dehydration unit one man can adequately take care of this

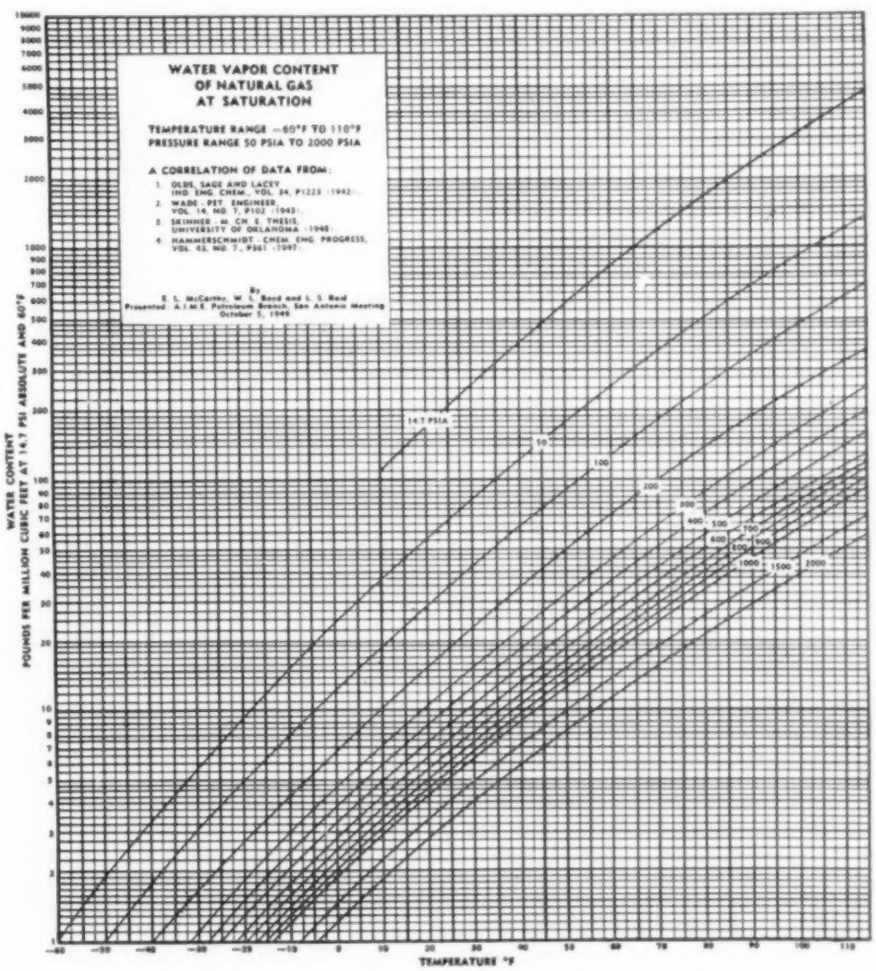

WATER VAPOR CONTENT
OF NATURAL GAS
AT SATURATION
TEMPERATURE RANGE —60°F TO 110°F
PRESSURE RANGE 50 PSIA TO 2000 PSIA
A CORRELATION OF DATA FROM:
1. OLDS, SAGE AND LACEY, IND. ENG. CHEM., VOL. 24, P1223 (1942).
2. WADE - PET. ENGINEER, VOL. 14, NO. 7, P102 (1943).
3. SKINNER - M. CH. E. THESIS, UNIVERSITY OF OKLAHOMA (1946).
4. HAMMERSCHMIDT, CHEM. ENG. PROGRESS, VOL. 43, NO. 7, P361 (1947).
By
E. L. McCarthy, W. L. Boyd and L. S. Reid
Presented A.I.M.E. Petroleum Branch, San Antonio Meeting
October 5, 1949
WATER CONTENT
POUNDS PER MILLION CUBIC FEET AT 14.7 PSI ABSOLUTE AND 60°F
14.7 PSIA
TEMPERATURE °F

FIGURE 3—Water vapor content of natural gas at saturation.

unit and still have time for other maintenance. It has been the practice of some companies to assign 12 to 15 multiple field units to one operator. By assigning each well attendant a limited number of units he is able to do preventive maintenance to each unit and also keep them in good appearance.

Operation of Dehydrator. Figure 4 is a basic flow diagram for glycol dehydrators. Glycol from the reboiler flows through a downcomer into the storage tank which contains a heat exchanger coil to cool the glycol going to pump suction. The glycol is then pumped through the cooling coil and into the top of the absorber tower. The glycol is cooled by the gas that has been dehydrated so as not to raise the temperature of the gas that comes in direct contact with the glycol on the trays. Contact temperature on the top tray is a factor in the final outlet dewpoint of the gas. The glycol flows down from tray to tray until it reaches the accumulator section and is then discharged from the tower. It will be noticed that the glycol flows countercurrent to the flow of gas, letting the highest concentration of glycol come into contact with the gas of lowest water content.

Bubble caps are used nearly universally for glycol dehydration because of their flexibility. Other types of tray have been used with a high degree of satisfaction on towers where the liquid rate is high and the gas rate is low. In glycol dehydration the gas rate is high and the liquid rate is low and leakage from tray to tray cannot be tolerated. Dehydrators with bubble cap design have been operated from nearly no flow to 100 percent load with only a small variation in dewpoint depression. It is common practice to use four trays in units to obtain 70° dewpoint depression.

Glycol from the tower discharge is passed through a filter to remove foreign material. It then passes through the heat exchanger coil in the storage tank to preheat the still column feed. The still column is a packed fractionating tower furnishing its own reflux. Water vapor is discharged from the top of the tower and the glycol is refluxed back into the reboiler.

The reboiler can be heated by one of three systems: Steam, hot oil or direct firing. Direct firing is the most common since the others are generally not available at the plant site, however, steam or hot oil are very desirable in plant operations where direct firing becomes a fire hazard. The only limitation to the location of the reboiler with respect to the absorber tower is the pressure drop in lines to and from the reboiler and absorber and also the temperature between the two. If the glycol reaches a temperature lower than approximately 30° F. it becomes so viscous that trouble may be encountered in getting the glycol to and from the absorber tower on a remotely located reboiler. The lines can generally be placed together and insulated to prevent the glycol from getting too cold and viscous.

Where operation is above 300 pounds and below 100° F. the recommended circulation rate is three gallons of triethylene glycol per pound of water removed. It has been reported that 70° dewpoint depressions have been obtained with a circulation rate of two gallons of triethylene glycol per pound of water removed. This can probably be accounted for by the low contact temperatures. In glycol dehydration contact temperatures of more than 100° F. will sometimes not give the desired outlet water content, and below 40° F. the glycol becomes viscous and good contact is not available between the glycol and gas, also resulting in a poor dewpoint-depression. Regeneration temperatures of triethylene glycol should range from 350° to 375° F. As was pointed out earlier, degradation of glycol at these temperatures is nil and this range produces in excess of 98 percent concentration of glycol.

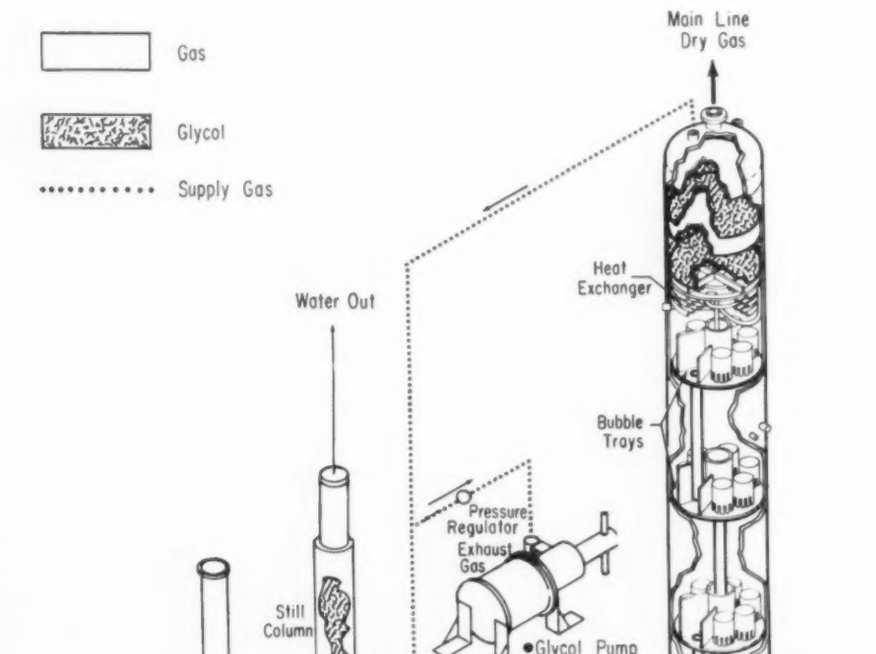


FIGURE 4—Basic flow diagram of typical wellhead or small centralized dehydration plant. On large pipe line installation size prevents stacking reboiler on top of storage tank and external heat exchangers would be required.

Pipe Line Installation Larger. The foregoing flow diagram is typical for

wellhead dehydration plants or for a small centralized plant. On a large pipe line installation the size prohibits stacking the reboiler on top of the storage tank, therefore they become two separately mounted vessels. The heat exchanger becomes too expensive to insert the coil in the storage tank, so external liquid-to-liquid heat exchangers are used instead. Also the coil shown in the top of the absorber tower to cool the incoming glycol is replaced by an external heat exchanger using either air or water cooling because the cost becomes prohibitive to install a coil of sufficient size to cool large amounts of glycol.

Climate Must Be Considered. Since dehydration has become more of a problem in the cold weather countries than in the warmer climates it has brought about the revision of the standard unit to what is known as a cold weather unit. The cold weather unit uses the heat that is left in the glycol after leaving the storage tank to advantage by passing the hot glycol through a coil in the bottom of the inlet separator, a jacket on the separator liquid dump line and a jacketed level controller on the separator. Heating prevents freezeups in these locations.

The exhaust gas from the pump passes through a heating coil in the reboiler and is injected into the liquid line from the separator to the stock tank. This keeps the line free of fluid and eliminates possibility of water freezing in this line. Instead of bringing the water vapor out of the top of the still column an internal pipe comes from the top of the still column down to the bottom sections in order to get superheating of the steam leaving the reboiler. In extremely cold country, such as Wyoming and Canada, it is necessary to insulate the bottom section of the separator. Some operators even go to the expense of housing the complete unit.

Pump Maintenance. Preventive maintenance was mentioned earlier. There isn't much one can do in the field since few moving mechanical parts are present, pump packing being the principal item. Many types of packing have been tried and usually all of these give satisfactory service if treated with care. Careful starting of a new pump can save much worry and down time. The pump packing as used on most glycol service is nonlubricated except by the glycol itself. When the pump is new, the packing is dry. As it soaks up glycol it tends to expand. If it has been screwed down too tight, either the packing will score the plunger or the packing will burn out. Complete leakage cannot be stopped on these types of pumps without high replacement costs. Filter elements must be replaced periodically because of plugging with foreign material.

About the Author

Warren E. Richardson graduated from Kansas State Coolege in 1950 with a BS degree in electrical engineering. Following graduation, he was employed by Cities Service Gas Co., Oklahoma City, where he gained experience as a pipe line foreman, construction superintendent and construction engineer. In 1953 Warren joined the Sales department of Black, Sivalls and Bryson, Inc.'s Oilfield Equipment division and in 1956, was promoted to technical service engineer, process equipment. He is stationed in Oklahoma City.

EDITORIAL INDEX

Do you need to know when and where a certain article appeared in PIPE LINE INDUSTRY? The 1957 Editorial Index provides a time-saving entry into all 12 issues published last year.

Indexed by subject and by author, it is bound in handy pamphlet form for easy accessibility. To get your copy, write Librarian, Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas. Or, if you prefer, check the square provided on the blue Reader's Service Card at the back of this and every issue of PIPE LINE INDUSTRY.

The supply is limited, so a quick order will assure you of getting a copy.

Fire tube inspection should be periodic. Salt deposits, caused by separator carryover is probably the most common cause of firetube failure. Immediately following the burner shut off, a look into the tube after dark will reveal any hot spots. If these exist then it is recommended that the tube be pulled out and cleaned. Glycol should be checked for salt content. If salt exists, then reclaiming or discarding should be carried out. Reclaiming is done by vacuum distillation.

Dump valves should be checked for leakage. This can be done by observing the levels while the valve is in the off position.

Hazards Eliminated in Design. When installing glycol dehydration units, designing the piping to prevent fire hazards is important. Especially on the smaller units, the storage tank is generally not large enough to handle large volumes of excess fluid. If a large hydrocarbon liquid load passes through the separator and enters the absorber, it will then follow the same route as the glycol. Being lighter than glycol it will overflow the storage tank and possibly the still column and spill upon the ground. If the storage tank vent and the still overheads are not piped away from the unit a fire will probably result. If they are piped away, they might flash at the ends of the pipe but will do no damage. Again this is only a possibility but it is an insurance policy for only a few dollars.

Heavy paraffin oils have produced glycol emulsions. Compressor oils and absorption oils are refined products and do not seem to give any operating problems. They can be skimmed from the top of the glycol in the storage tank.

In conclusion, multiple wellhead units have a higher installation, operation and maintenance cost but they give complete protection from wellhead to consumer. The amount of protection that the operating company desires will determine the cost of this installation.

BIBLIOGRAPHY

[1] Katz, D. L., "Prediction of Conditions for Hydrate Formation in Natural Gases," Pet. Eng. Ref. Annual, V16, No. 10, 223 (1945)

[2] Gallagher, A. F. and Hibbert; Journal of the American Chemical Society, Vol. 59 (1937) page 2524

[3] Polderman, L. D., "Glycol Degradation in Gas Dehydration Service," P24, Proc. Gas Cond. Conf., Univ. of Okla. (Mar. 16-17, 1954)

[4] Polderman, L. D., "Equilibrium Dewpoints in Natural Gas-Glycol Systems," Proc. Gas Cond. Conf., Univ. of Okla., (Mar. 29, 1955)

A typical downward impingement fire. This type fire is caused by a split in the bottom of the pipe. Flames strike the bottom of the bell hole and are reflected up around the pipe. Impinging fires are the most difficult to control.

Control of natural gas fires

A better understanding of gas fires results from a series of tests on simulated fires.

By Arthur B. Guise
Technical Director
Ansul Chemical Company
Marinette, Wisconsin

ALTHOUGH THERE have been a number of fires involving high pressure natural gas, no study had been made regarding methods of fighting these fires. Because of this lack of information, one of the large gas transmission companies in conjunction with a chemical company cooperated in making a series of fire tests. The tests were designed to determine:

- The suitability of dry chemical fire extinguishing equipment on typical natural gas fires.
- The proper size and type equipment for compressor stations.
- The limiting volumes and conditions under which burning gas can be extinguished by various size dry chemical units.

A test site was constructed near a source of 850 psi gas. Gas was delivered through a six-inch line, which was anchored to a concrete block for safety.

A meter run was provided in the pipe where the flow of gas could be measured accurately. A number of fittings allowed the gas to be discharged vertically or horizontally through a ½, 1, 1½, 2 or 4-inch orifice, or without restriction from the six-inch line. A tap was also provided near the end of the six-inch pipe so the pressure could be recorded.

Actual Fires Simulated. The tests duplicated as nearly as possible the conditions which might be met in actual instances of gas transmission. The fires included:

- Vertical jet with six-foot stack on outlet.
- Low level vertical jet.
- Horizontal jet.
- Horizontal jet impinging against earthen bank.
- Horizontal jet impinging against steel plate.
- Downward impingement.
- Pit fire with gas discharging from slit in bottom of pipe.

Dry chemical fire extinguishing equipment was used exclusively for the tests. Four-pound, 20-pound, and 30-pound hand portable extinguishers were used as well as 150-pound and 350-pound wheeled extinguishers. Three sizes of stationary extinguishers including the 500-pound, 1000-pound and 2000-pound extinguishers were also used.

Part of the test program was conducted to find out which fires could be attacked by fire fighters in normal

work clothing and which ones require special protective equipment.

Extent of Tests. A few statistics will give an idea of the extent of the tests.

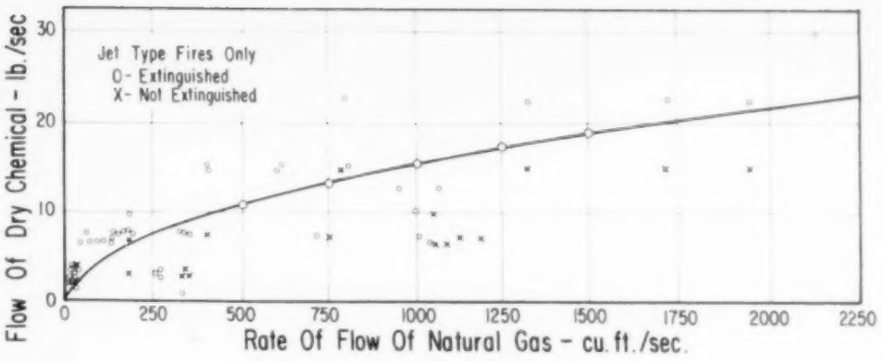
- A total of 191 tests was conducted during eight days.
- 930,563 cubic feet of gas were discharged.
- The maximum rate of gas flow for one test was 2610 cubic feet per second (equivalent to 225,504,000 cubic feet per day).
- 47,000 pounds of dry chemical were used during the tests.
- 57,640 cubic feet of nitrogen were used to expel the dry chemical.
- Sixteen engineers and technicians from the gas transmission company and eight from the chemical company took part in the tests.

Impinging Fires Most Dangerous. The general conclusion drawn from the tests was that dry chemical fire equipment is suitable for use on natural gas fires involving pressures up to 850 psi. Fires such as these may occur not only in transmission lines, but at producing wells, at gas utility plants or at the plants of gas consumers. As anticipated before the tests began, it was found that impinging type fires are more difficult to extinguish than the freely discharging or jet type fires. Impinging fires require more and/or larger equipment for extinguishment.

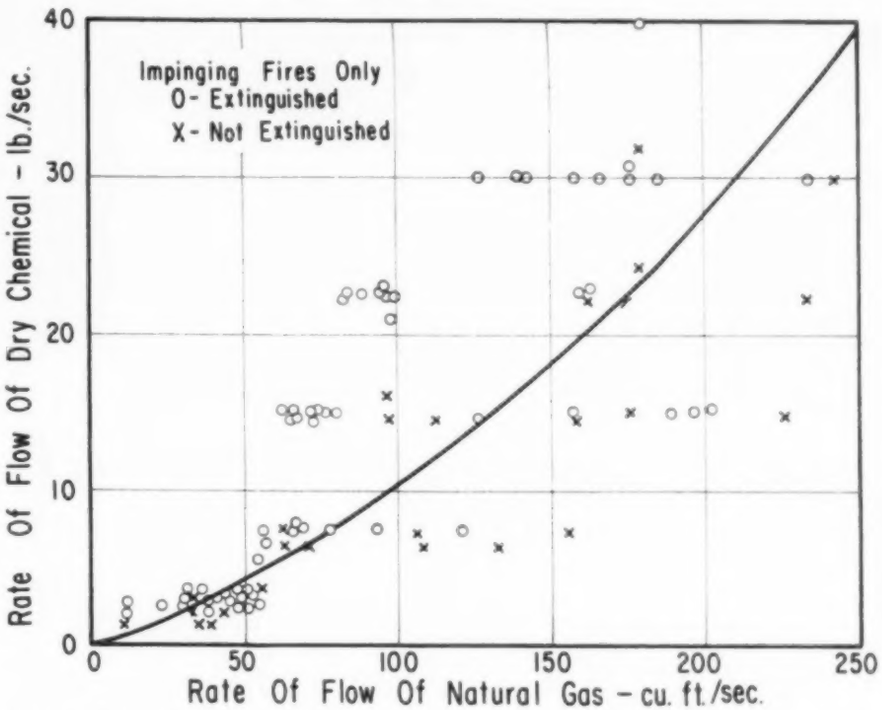
Clothing Depends on Fire. Most non-impinging fires can be approached by men wearing ordinary work clothing, since the dry chemical stream affords considerable protection against the heat. Wool clothing is recommended, however, because it is harder to ignite than cotton.

Where there may be large impinging type fires, protective clothing is needed. Fire fighters in these tests used bunker coats and safety helmets with ⅛-inch thick plexiglass face shields. With this protection, a man can get close to very severe fires without danger.

Gas Flow Vs. Chemical Flow. In reviewing the data from the tests, engineers found a relationship between the rate of flow of the natural gas and the rate of flow of dry chemical required to extinguish the fire. The hand and wheeled extinguishers used



Flow and rate of gas flow for jet type fires.



Record of test showing relation between rate of chemical flow and rate of gas flow for impinging type fires.

First attack is made on an impinging horizontal jet fire with two hose lines. Two additional hose lines were required to extinguish the fire.

Attacked with two lines, 6-inch jet impinging on a steel plate was extinguished in 37 seconds. Discharge of dry chemicals was continued for another 13 seconds while the plate cooled.

Slit cut in the bottom of 6-inch pipe to simulate rupture in a buried pipe line. Fire will impinge on bottom of bell hole making the fire difficult to control.

in the tests had the following average flow rates:

Extinguisher Size	Chemical Flow Rate lb. per second
20 Pound	2.0
30 "	2.0
150 "	2.5
350 "	3.0

The 500-, 1000- and 2000-pound stationary extinguishers will supply one, two, and four one-inch hose lines, respectively. Each of these one-inch hose lines has a flow rate of 7.5 pounds of dry chemical per second.

A large pit fire is attacked. Gas is flowing from the "split pipe" at a rate of 186 cubic feet per second. The fire was extinguished in 3.8 seconds using 4 hose lines from a 2000-pound dry chemical stationary extinguisher.

Data supplied with the equipment coupled with the charts on dry chemical flow rates in impinging and non-impinging fires, can be used to determine what fire equipment may be needed to extinguish a given fire.

Heat Content of Gas Important. Here, engineers caution that the charts are based on the 1000 Btu gas used in the tests. Data which has been gathered in other tests indicates that the difficulty of extinguishment and the amount of equipment needed will decrease or increase with flammable gases having a heat content below or above this figure. Known exceptions are hydrogen or carbon monoxide which require special consideration.

How to Use Charts. One thousand Btu gas is escaping from a vertical jet at a rate of 750 cubic feet per second or about 66 million cubic feet per day. A vertical line is drawn from 750 on the horizontal axis to the curve of the chart on non-impinging type natural gas fires. A horizontal line is drawn from the point of intersection to the vertical axis where the dry chemical flow required for extinguishment is found to be 13.5 pounds per second. Five wheeled extinguishers or two one-inch lines from stationary extinguishers will provide the necessary rate of dry chemical flow. These charts and calculations are based on equipment used by trained, but not expert, personnel. Of course they do not provide an infallible method of extinguishing natural gas fires. However, they are an accurate guide to the amount and capacity of the dry chemical equipment needed. —**The End**

On G & H Constructors spread, one "boomer" cradles pipe while a second handles coating and wrapping machine. Five tractors were used on the spread that completed Okan Pipeline's new 6-inch gathering line.

Rubber-tired boomer speeds 6-inch job

Contractors, farmers, and pipe line company inspectors were impressed with the performance of the light-weight mobile equipment used on this gathering line work.

By Ernest A. Slade
Okan Pipeline Company
Tulsa

A NOVEL COMBINATION of a rubber-tired farm tractor with a counterweighted sideboom, was recently used to construct about six miles of six-inch pipe line for Okan Pipeline Company near Enid, Okla. The new equipment made fast work of this short line. Contractor on the job, G

Mobility and versatility of the rubber-tired pipe laying tractors were advantages commented upon by contractors, company inspectors, and farmers.

Little right-of-way work was left to be done after the line was lowered-in and backfilled. Some wheat fields were disced for re-sowing; other farmers wanted theirs left to grow back after the spread moved on.

The rubber-tired boomer handles pipe bending with ease. Mounting a bending shoe on the sideboom attached to the tractor performs the job.

& H Constructors of Britton, Okla., used the job to field test the versatility of the new sideboom tractor on rubber.

Five units were used on the spread. The sideboom attachment is mounted on a standard model farm tractor with only minor modifications. Structural strength of the solidly braced frame of the tractor takes the strain placed upon it by the hoisting of a 3000-pound load at a ten-foot boom extension from the side of the tractor. A hydraulically controlled 1000-pound counterweight gives the operator complete control of any load the sideboom is capable of handling.

Use of calcium chloride solution in the oversized rear wheel tires assists in holding the tractor stable while handling the pipe string. One limitation of the "boomer" is in turning—it cannot turn as readily as track-laying tractors. Backing must be resorted to in order to turn sharply.

Cuts Cleanup Time. Use of the rubber-tired sidebooms when crossing farm lands such as were encountered on this job smooths right-of-way relations with farmers. The tractors do not have the tendency to pack the working side of the right-of-way to the extent that conventional track-laying mobile equipment might. This allows the ground to be easily broken by farming machinery.

Pipe line companies often require the contractor to loosen up the soil along the pipe line right-of-way during the final clean-up job, restoring the ground to its original condition.

Use of this rubber-tired equipment simplifies that task; it also makes a favorable impression on the landowner who is familiar with this type equipment.

Light Equipment Handled Job Well. The contractor encountered no difficulties on the job by virtue of the fact that he was using equipment lighter than conventional tractors. One boomer was used in the pipe gang to make all bends by means of a bending shoe mounted on the sideboom; another was used in the lay gang to align the pipe for stovepipe welding. A third cradled the pipe ahead of the cleaning or coating machines; the tractor was also used to handle the coating and wrapping machine and for lowering into the ditch. Still another unit was available for use on the back end making tie-ins at road and railroad crossings.

The equipment is very mobile along the right-of-way, being able to travel at rates up to 30 miles per hour when moving from one location to another. On short hauls they were driven along the roads without incident, cutting down on the use of heavy trucking equipment to shift machinery along the spread.

Versatility of the machine is a big advantage; a unit can also be equipped with hydraulically operated dozer blades, back hoe attachments and ditching wheels, making a very flexible piece of basic equipment for the small size pipe laying contractor. Repair parts for the tractor itself can be obtained at any local farm machinery equipment company.

It has been reported that up to 16-inch pipe has been laid in city gas distribution systems using the rubber-tired boomer. Because of its ease of maneuverability and versatility, this equipment could well fill several needs of many pipe line crews laying gathering lines and also in the maintenance of smaller lines. —**The End**

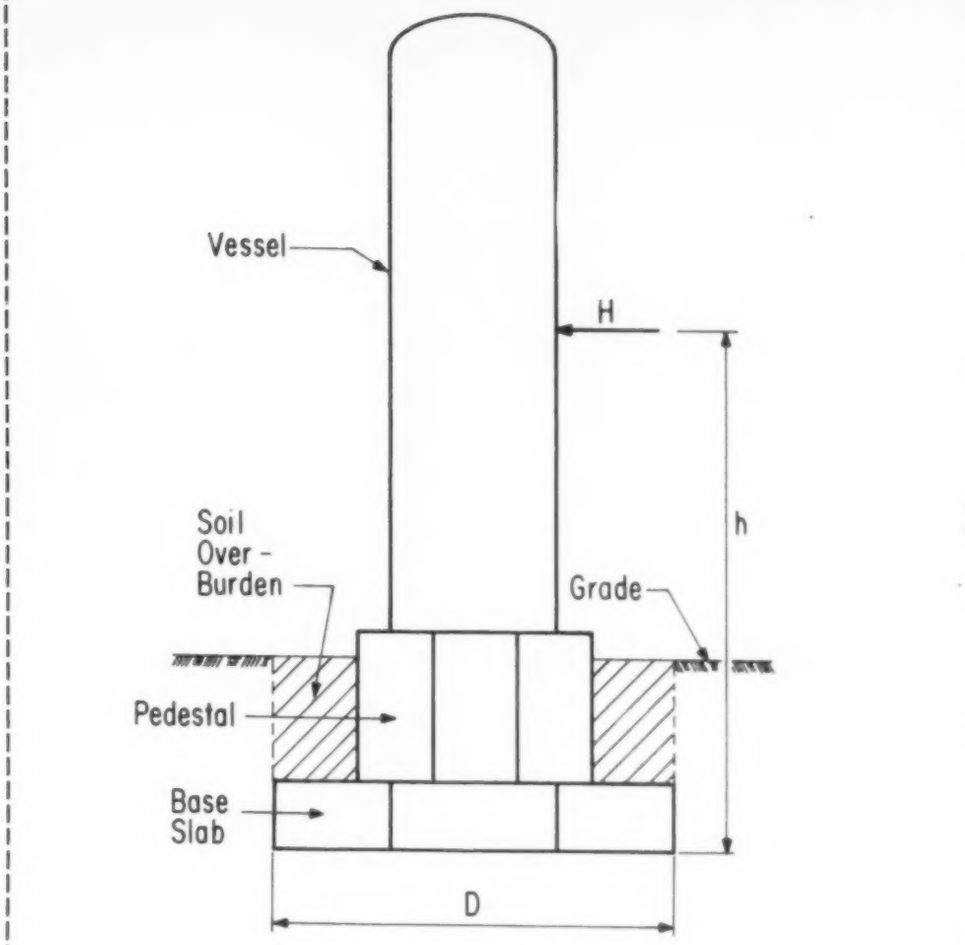


FIGURE 1—(Example) Typical vessel supported by an octagonal foundation.

Graphs simplify design of pads

This time-saver will help you to determine the economical sizes of octagonal and square footings used for station appurtenances.

By John B. Grant and Raymond J. Smith
Macco Corporation, Paramount, Calif.

OCTAGONAL and square pads used to support vertical vessels, scrubbers, stacks, and similar station equipment may be taking up a lot of unnecessary engineering time. Structural designers normally rely on a trial and error procedure of determining a satisfactory size for these foundations. Trial and error procedures are, by their nature, time consuming and therefore expensive. The charts presented in Figures 2 and 4 offer an exact and rapid graphical method of determining economical sizes for octagonal and square footings. Although these charts were initially developed as a design aid, they have proven to be quite useful for estimating and checking purposes. They have been used by Macco Corporation's structural

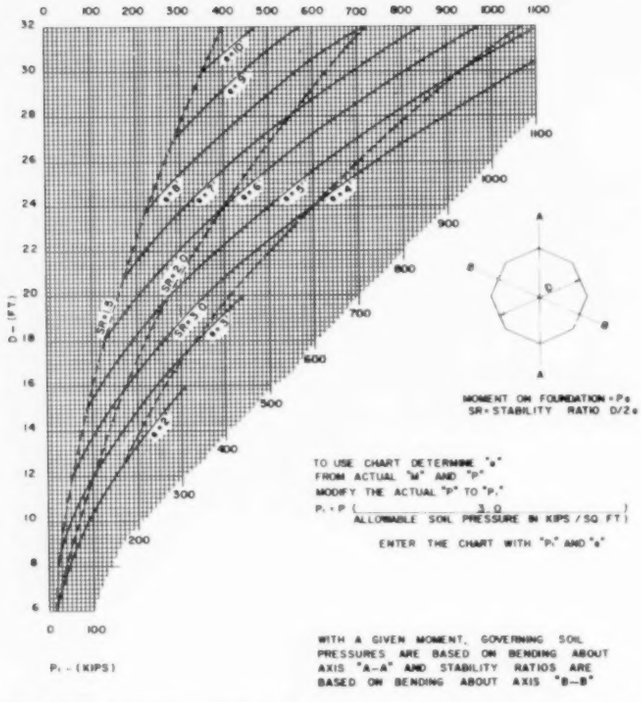

MOMENT ON FOUNDATION = Pe
SR = STABILITY RATIO D/2e
TO USE CHART DETERMINE "e"
FROM ACTUAL "M" AND "P"
MODIFY THE ACTUAL "P" TO "P,"
ENTER THE CHART WITH "P," AND "e"
WITH A GIVEN MOMENT, GOVERNING SOIL PRESSURES ARE BASED ON BENDING ABOUT AXIS "A–A" AND STABILITY RATIOS ARE BASED ON BENDING ABOUT AXIS "B–B"

FIGURE 2—Exact graphical method for octagonal footings.

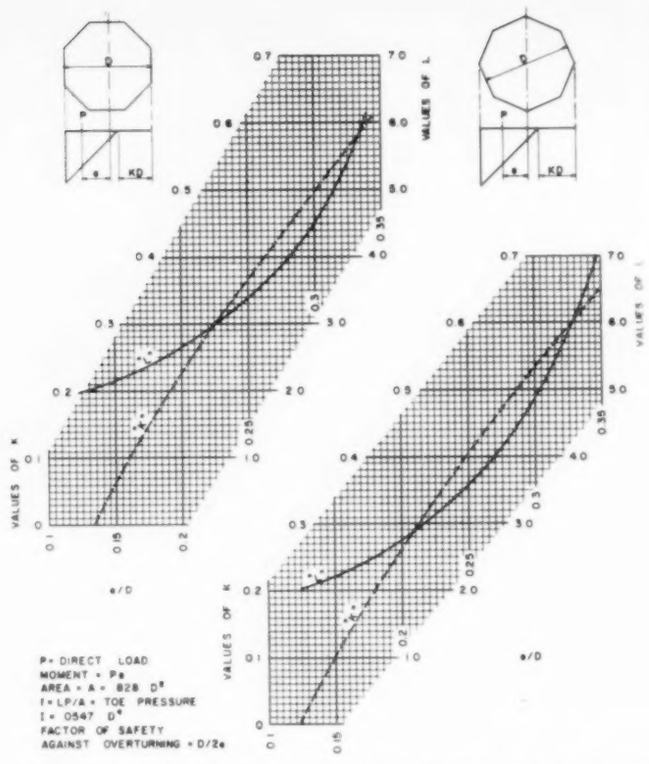

VALUES OF K
e/D
VALUES OF L
P = DIRECT LOAD
MOMENT = Pe
AREA = A = .828 D²
f = LP/A = TOE PRESSURE
I = .0547 D⁴
FACTOR OF SAFETY AGAINST OVERTURNING = D/2e

FIGURE 3—Vertical load eccentricity is measured from centroidal axis.

design group for over two years and found to be accurate as well as time saving.

Example. The use of the sizing charts may best be illustrated by an example. Assume a vertical vessel as shown in Figure 1 and the following design criteria:

For illustration purposes, the example has been limited to the operating condition plus wind or seismic. In actual practice, however, the other design conditions such as the empty condition plus wind or seismic and the test condition with or without wind or seismic must be investigated. Furthermore, the overturning moment (H x h) has been assumed as resulting from either wind, seismic, or other forces.

Design Criteria

Operating Weight	= 120^k
Horizontal Force "H"	= 10^k
Distance "h"	= 53.5 ft.
Allowable gross soil bearing pressure	= 4.0 ksf
Minimum allowable stability ratio against overturning	= 1.5

In order to use the charts, first determine the gross load "P" and the moment "H x h" at the base of the footing.

Gross Load

Vessel Weight	= 120^k
Concrete Pedestal	= 28
Concrete Base Slab	= 49
Soil Overburden	= 35
Gross "P"	232^k

Moment

$M = 10^k \times 53.5 \text{ ft.} = 535 \text{ ft.}^k$

From "M" & "P" the eccentricity may be found:

$$e = \frac{M}{P} = \frac{535 \text{ ft.}^k}{232^k} = 2.30 \text{ ft.}$$

Since the sizing charts were prepared on the basis of an allowable soil bearing value of 3 ksf, the gross load "P" must be adjusted to "P_1", before entering the chart.

$$P_1 = 232^k \times \frac{3 \text{ ksf}}{4 \text{ ksf}} = 174^k$$

Entering the octagonal foundation sizing chart (Figure

About the Authors

JOHN B. GRANT is chief civil engineer, Refinery & Chemical division, Macco Corp., Paramount, Calif. He graduated from the University of Kansas in 1949 with a B.S. degree in civil engineering. Grant's professional career has been spent in structural engineering for bridges, refineries, and chemical plants. He is a licensed civil engineer in California and Kansas.

Grant

Smith

RAYMOND J. SMITH is a civil engineer, Refinery & Chemical Division, Macco Corporation, Paramount, Calif. He received his B.S. degree in civil engineering from Texas Technological College in 1941.

Smith's professional career spent in design of highways, highway bridges, and industrial structures. He is a licensed civil engineer in California, Texas, and Kansas.

) with the above values of "P_1" and "e", a value of 3.2 feet is obtained for the dimension "D." At the same ime it may be noted from the chart that the stability atio is 2.9, which is greater than 1.5.

The maximum foundation pressure will now be hecked. Use D = 13 feet 3 inches. Referring to the chart f Figure 3:

$$e/d = 2.30/13.25 = 0.174, K = 0.182, L = 2.44$$

$$\text{Area "A"} = 0.828\ (13.25)^2 = 145.4 \text{ sq. ft.}$$

$$f = \frac{LP}{A} = \frac{2.44 \times 232}{145.4} = 3.89 \text{ ksf} < 4.0 \text{ ksf allowable}$$

With the information obtained from Figure 3, the complete design of the concrete base slab may be made.

Note that the weights of the concrete pedestal, base slab and soil overburden must first be assumed to obtain a gross value of P. If the values assumed differ too greatly from the chart sizes indicated, a new assumption of weights must be made. This procedure is analagous to that of assuming the dead load of a beam to combine with other loads for its design.

While the octagonal sizing chart was used in the above example, the sizing chart presented in Figure 4 for square foundations is used in exactly the same manner.

Derivation of Charts. Literature in common usage presents charts for various shaped foundations similar to those shown in Figures 3 and 5 where $L = \frac{FA}{P}$. These charts are derived from the basic formula for maximum soil pressure, $f = \frac{P}{A} + \frac{Mc}{I}$.

However, since the economical or useful portions of these charts lies between the limits where tension would exist on the heel of the pad up to the point where the stability ratio against overturning is one and one-half, the basic formula is not correct without re-definition of certain of its terms:

A = The area of the pad actually under compression.
M = The moment of the vertical forces about the centroidal axis of the area under compression.
$\frac{I}{C}$ = The section modulus of the actual area under compression about its centroidal axis.

For this compressive area it is of interest to note that the average unit compressive stress occurs at the center of gravity of the compression area.

Definitions of the terms in the formula $L = \frac{FA}{P}$ and the terms needed for the graphic solution for "L" are:

F = Maximum soil pressure in kips per square foot.
P = Total vertical load on soil in kips.
A = Total area of foundation pad in square feet.
D = Distance in feet as shown in figures 3 and 5.
e = Eccentricty of vertical load in feet $= \frac{M}{P}$
L = A constant for any given value of $\frac{e}{D}$

Note that in the case of Figures 3 and 5, the eccentricity of the vertical load is measured from the centroidal axis of the total area of the foundation pad. By assuming values for "D", "F" and "e", values of "L" and "P" may be obtained to plot the data for figures 2 and 4.

Extending and Other Charts. These particular sizing charts have been prepared for footings loaded by vertical load and a moment of the same magnitude about any axis. They may be extended as desired by following the procedure outlined above.

Charts for rectangular and other shaped footings may be prepared by following a similar procedure to that used in the development of these charts. Only the sizes normally encountered in a particular practice need be included.

—The End

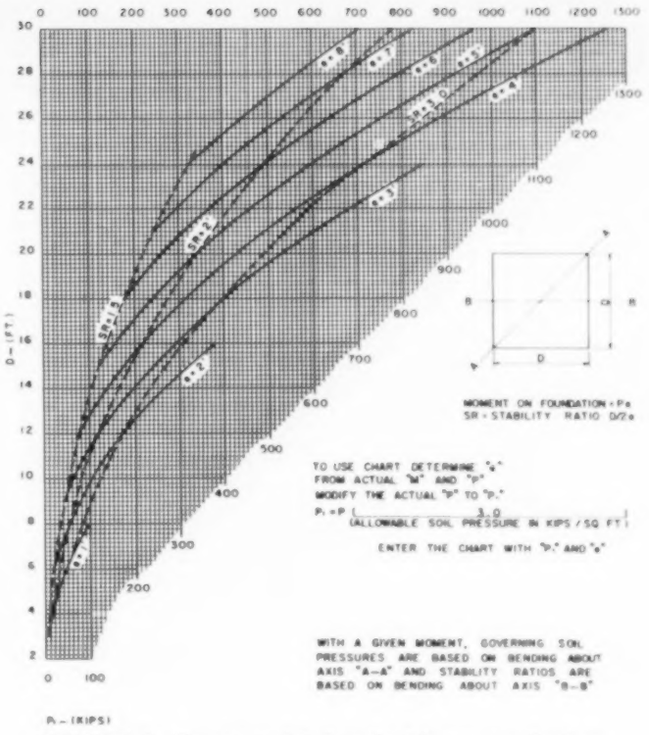

D – (FT)
P – (KIPS)
MOMENT ON FOUNDATION = Pe
SR = STABILITY RATIO D/2e
TO USE CHART DETERMINE "e"
FROM ACTUAL "M" AND "P"
MODIFY THE ACTUAL "P" TO "P1"
ALLOWABLE SOIL PRESSURE IN KIPS / SQ FT
ENTER THE CHART WITH "P1" AND "e"
WITH A GIVEN MOMENT, GOVERNING SOIL PRESSURES ARE BASED ON BENDING ABOUT AXIS "A–A" AND STABILITY RATIOS ARE BASED ON BENDING ABOUT AXIS "B–B"

FIGURE 4—Exact graphical method for square footings.

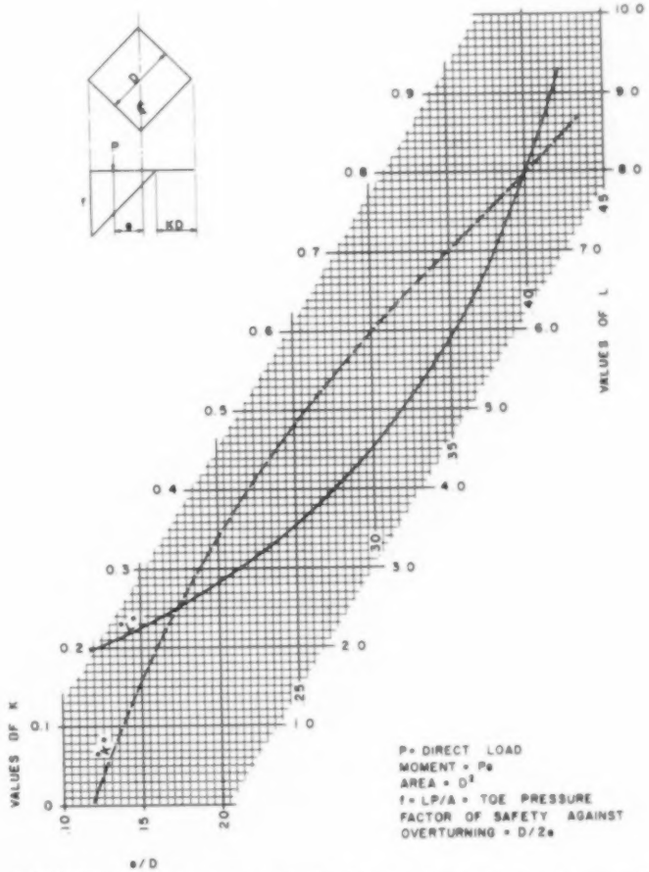


FIGURE 5—This chart is derived from the basic, maximum soil pressure formula, $f = \frac{P}{A} + \frac{Mc}{I}$.

Rules of Thumb

and Engineering Data Sheets for the Pipeliner's field notebook

$25 for Engineering Data Sheet $15 for Rule of Thumb

These practical aids give quick, reasonably accurate answers to design, maintenance and cost estimating problems. PIPE LINE INDUSTRY will pay $25 for each chart, nomograph or data sheet published—$15 for each Rule of Thumb. Send your ideas to PIPE LINE INDUSTRY, P. O. Box 2608, Houston, Texas

Construction —18—How to Lay Out Any Number of Equally Spaced Holes on a Bolt Circle

To lay out any number of equally spaced holes on a bolt circle.

Rule: The diameter of the bolt circle multiplied by the sine of one-half the angle of the arc between the holes will give the chord or the dimension to which the dividers must be set.

Example: Lay out 20 equally spaced holes on a 40-inch bolt circle.

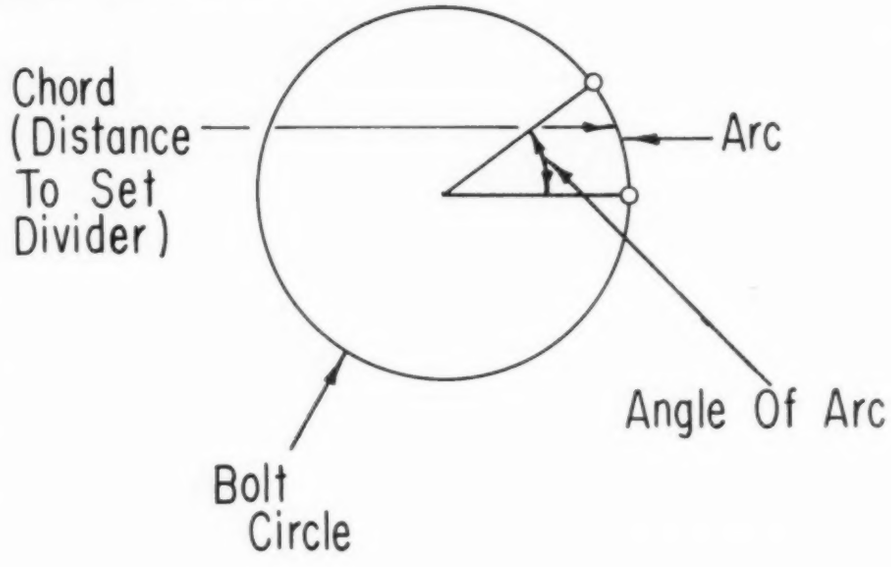
360° divided by 20 holes = 18°, angle of arc between holes

18° divided by 2 = ½ angle of arc between holes or 9°

Diameter of bolt circle = 40 inches

The sine of 9° = 0.15643

40 × 0.15643 = 6.257 inches, the chord or amount to set dividers



Miscellaneous —34—Locating Decimal Points

An accurate method of locating the decimal point when multiplying with a slide rule is based upon the use of the characteristics of the common logarithms of the numbers involved. Basically, the system is employed simply by adding the characteristics of each quantity in the numerator and subtracting the characteristics of each quantity in the denominator to obtain the characteristic of the answer. There are two exceptions to the basic method which must be considered.

1. When multiplying, one must be added to the characteristic when the C scale is moved to the left of the D scale in order to perform the multiplication.
2. When dividing, one must be subtracted from the characteristic when the C scale is moved to the left of the D scale in order to perform the division.

The following example illustrates the use of the method.

$$865 \times 0.0035 = 3.03$$

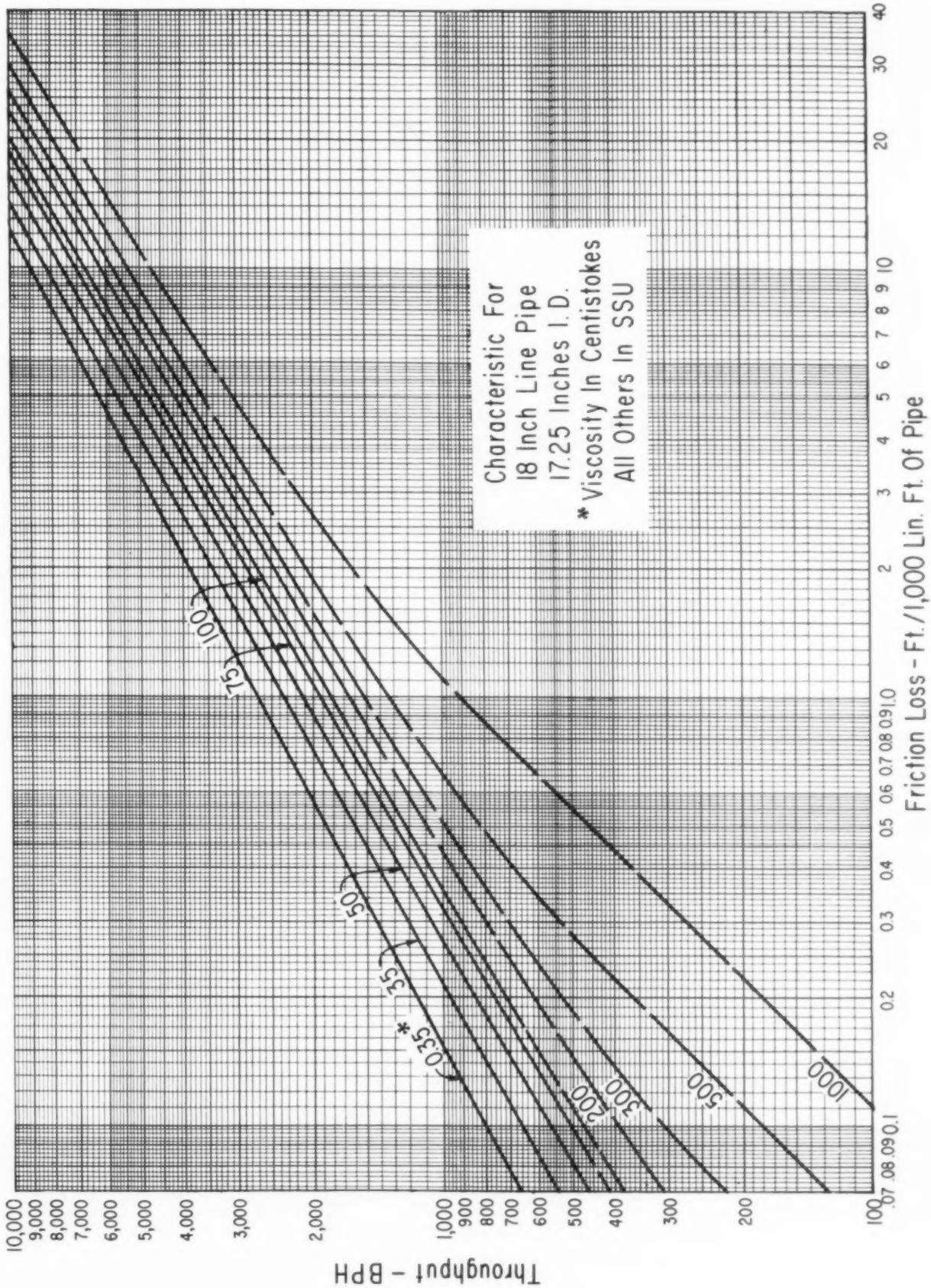
Addition of the characteristic of 865 (2) to that of 0.0035 (—3) results in a characteristic for the answer of —1. However, the C scale was moved to the left of the D scale to perform the multiplication which means that one must be added to make the characteristic zero. This calls for placement of the decimal point as shown.

Engineering Design —42—Head Loss Charts for Various Sizes of Pipe

Friction Loss Characteristics for 18-inch pipe were computed by a pipe line company using data of the Hydraulic Institute. Use of this data in laminar and critical zones is adequate for estimates. Friction losses in transition and complete turbulent zones are very accurate.

(Chart 8 in a series of 19—18-inch line pipe)

ENGINEERING DESIGN 42



"Do's and Don't's" for Training Instructors

DO	DON'T	SUGGESTION
Keep trainee informed of his progress, his successes, his mistakes and his opportunities.	Stifle initiative by too close supervision.	When possible, make knowledge of progress: a. Automatic b. Prompt c. Natural to the situation—let trainee find out for himself or tell him constructively.
Teach as fast as practicable and in large amounts so as to give interest and meaning.	Allow habit interference.	Analyze the situation. Push ahead, but watch for danger zones of overlapping habits.
Use a variety of practice materials.	Allow unjustified expense and delay.	Simulate essential situations. Teach general principles. Help trainee develop ability to meet new situations.
Teach general principles.	Assume that trainee will apply them when the time comes.	Assign problems so that he has to work his way out by applying principles.
Provide guidance. Encourage learning by correct doing.	Give too much. Give it too soon. Give it too late.	Guide in early stages and until trainee can make more progress alone. Encourage initiative.

Streamline your training courses

Here are five "keys" to better training that will help improve any company program.

By Carl Mullins White
Service Pipe Line Company, Tulsa

How can a company know its training program is producing results that justify the dollars spent?

It is difficult to answer this question in many aspects of training. A worker's strengthened loyalty, a supervisor's deepened insight, an executive's stimulated imagination are important but hard to evaluate.

It is sometimes just as difficult to know what training efforts have brought about these desired results—or how.

Even with something as tangible as operating a machine, you might be able to measure increased output after training and still not be able to say definitely what training procedures got the best results—or whether some of the procedures actually interfere with learning.

However, there is one thing certain. Concentration on certain areas of training can improve the entire program. Through objective experiments, psychologists have developed valuable information on some of these areas. By using their findings intelli-

gently you can improve your own training methods along those certain lines.

Following are five areas that psychologists say should receive particular stress in every training program:

- Let the trainee observe his progress.
- Avoid habit interference.
- Use a variety of training materials and aids.
- Teach trainees the principles of their jobs.
- Provide guidance.

Even though these areas apply more forcefully to training in skills, some of the principles could be applied to other courses.

Trainee's Progress. Generally, it is helpful to let the trainee know the success or failure of his efforts. A man's nervous system is in equilibrium when he is succeeding. When failing, he develops tensions and an unpleasant state. These tensions, and satisfaction which he experiences react as punishments and rewards to spur him on. The joy of achievement may give a man a strong sense of satisfaction from doing an otherwise unpleasant task. This is especially true if he not only knows that he is making progress but knows that his boss knows he is making progress.

Instructors can help by:

1. Seeing that the trainee's knowledge of his successes and mistakes is prompt, definite and meaningfully related to the task he wants to learn.

2. Being specific—letting the trainee know the degree and direction of his mistakes, not merely that he is or is not "making satisfactory progress."

Human nature is complex, but it responds to punishments and rewards closely associated to its actions. If a worker opens the wrong valve and causes a severe loss of stock or a flash fire, he will learn fast. The same man will manipulate valves on a synthetic trainer with little progress unless he recognizes his mistakes as they happen.

Here a legitimate question might be raised. If the supervisor or instructor has to be constantly telling trainees about their mistakes, will he be guilty of the "tight supervision" which is known sometimes to interfere with either learning or production? Obviously, he should use discretion to see that his advice is helpful. It is still better if he can arrange the situation so that correction is automatic. He ought to make it easy for trainees to observe their own progress and mistakes.

Habit Interference. Habit interference is the slowing of the learning process caused by confusion in a man's nervous system. This confusion is created by conflicting habits. A simple illustration of habit interference might be that of a small boy whose clothing catches fire. He once saw someone extinguish a fire by jumping in a pool. His Scoutmaster taught him to roll on the ground. His father instructed him to wrap himself in a blanket. All his life he has run for cover when in trouble. All of these response patterns try to assume mastery of him at once so that he may "freeze," unable to do anything.

Psychologists have developed the following principles from their research in habit interference:

a. If the trainee has to learn two or more different responses to approximately the same situation, he will learn slower.

b. If the trainee has to make very similar responses to two very different situations, he will learn slower.

c. When a trainee has one set of habits well learned and is trying to learn a new set of habits, he may run into habit interference.

d. When a trainee is learning two habit patterns at once, he will have serious habit interference at first (usually worse than "c" above).

e. Long training tends to correct habit interference, especially if trainee is informed of his progress. Natural punishment and reward help to eliminate mistakes and encourage learning.

Habit interference is a serious practical problem in the use of synthetic trainers. For instance, when training in the operation of a machinery control panel, the instructor will naturally try to obtain a synthetic trainer which duplicates as nearly as possible the actual working conditions to be encountered on the job. But when the trainee leaves the trainer and begins work, he will likely find some differences. There are three possible ways of meeting this problem:

a. Use several different trainers. This method is excellent but expensive. Clever use of less expensive aids to supplement the trainer may be just as effective.

b. Carefully analyze the differences between the trainer and the real machine and give the trainee corrective instruction.

c. Wait until one set of habits is thoroughly learned before starting to teach a new one. This method, if used to excess, will make training too slow and uninteresting. Trainee may miss the "picture" of the whole task, if it is chopped up into too many small pieces.

The training supervisor must take all factors into consideration and do the best he can in view of his trainees' capacity, the job, his budget and the training materials at hand.

But he must never forget the problem of habit interference. It is a serious one. When a man has been trained to act in a certain way in a given situation and when confronted with a similar set of conditions, he may act in the same way — with serious consequences.

The oil industry has invested heavily in the design of machinery control panels to prevent habit interference. The same rules apply to the design of training equipment.

Variety of Training Aids. Variety in practice material is generally beneficial. But there are instances when it is a hindrance.

Many experiments have been conducted to determine when the instructor should use a very few training materials and under what circumstances he should employ a greater variety. (See Table below).

Effects of Using Different Numbers of Training Aids

A. FEWER

Lower first cost.

Quicker, especially in learning simpler tasks.

Montonous.

Allows wrong habits to go unchallenged and become stronger.

Knowledge limited in application. Trainee may feel lost if confronted with new situations.

May emphasize a non-essential.

B. MORE

Higher first cost.

Slows training. May actually hasten learning of more complicated tasks.

Interesting.

One aid helps to correct mistakes and strengthen good habits learned on another.

Trainee learns general principles and procedures. He can apply his skills in many new situations.

Irons out extraneous matter. Helps

trainee to master the essential knowledge or skill.

It is usually impossible to simulate all the situations that a trainee will later face on his job. The instructor should analyze the situation to see what processes are essential, then:

a. Simulate and teach the essential processes as thoroughly as time and budget will permit.

b. Teach the general principles with the idea of helping the trainee to adjust to new situations.

Knowledge of Principles. Teaching the principles involved in his job usually benefits the learner in three ways:

a. Helps him to learn faster.

b. Helps him to apply his knowledge to new situations.

c. Increases his interest. It helps him to relate the lesson to his own needs. By understanding the overall purpose, he can see how each part of training helps him to do a better job and make progress.

But the instructor must always keep this warning in mind:

Simply learning a general principle does not guarantee that trainees will use it when the time comes. He can improve their capabilities if he will give them practice situations in which they are forced to try to analyze for themselves the similarities and differences between old and new situations.

Guidance. Does it help the trainee to learn a task if he is guided through it several times? The answer is yes.

Research shows that guidance is usually helpful if it is not overdone. The type and amount of guidance, of course, depends on the process you want to teach.

Like every good thing, guidance always reaches a point of diminishing return. If given at the wrong time or too much, it interferes with learning. If the trainee is not ready for it, guidance may confuse and discourage him. If given after he decides that he no longer needs it, the effect may be even more discouraging.

The advantages of proper guidance:

a. Uses the principle of learning by doing.

b. Prevents damages and injuries.

c. Speeds learning.

d. Increases memory.

e. Prevents the learning of bad habits. —**The End**

If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

What Part Does Oil Play in Railroading?

Ask any railroader what motivates his work and probably nine times out of ten his answer will be "oil." Today more than 26,000 oil-burning diesels have replaced almost 90 percent of the old-fashioned steam locomotives operating ten years ago, at a great economy in fuel. On the average, one diesel has been able to replace two or three steam engines. Oil fueled diesels transported an estimated 650 billion net ton miles of goods last year, consumer well over 3½ billion gallons of diesel fuels.

What Does It Cost to Increase Gasoline Quality?

American motorists like luxury travel—and the powerful, high compression cars they demand need top quality, high octane gasolines. According to one estimate, by 1958 it will take a fuel of about 95 octane to get top performance out of 90 percent of the cars on the road. And if present trends continue, high performance cars may require 110 octane gasolines by 1960. This is an expensive proposition when you consider that it costs the oil industry about $100 million to increase the national average gasoline octane rating by just one point.

Is Oil Getting Harder and More Expensive to Find?

Drake's well, which marked the commercial discovery of oil in 1859, produced from a depth of 69½ feet. Today the deepest production is from rock 20,741 feet deep in the earth. Cost to drill: $2.5 million or $110 a foot. Every year oil men have to drill deeper to find oil, and there's no peak cost in sight. One company has estimated there will be an 1100 percent increase in wells drilled 18,000 feet and deeper in California and the Gulf Coast—from seven in 1956 to 82 in 1965. Cost will soar skyward as the wells sink deeper.

How Do You Find Oil?

Oil men will go to any lengths to find the elusive mineral. One oil company uses a unique mountain-building machine to reconstruct the earth on a miniature scale. Sheets of rubber and clay representing rock layers are placed in a box with hinged sides that allow its deformation. By applying pressure to the sides of the box, folds equivalent to hills and mountains can be formed in the clay and rubber layers. Using this machine, scientists hope to get a clearer picture of how and where oil traps are formed in mountain areas.

Does the Oil Industry Pay Its Share of Taxes?

Taxes and fees collected directly from the oil and gas industry or the product it sells, account for more than half the income derived by the State of Louisiana from state sources. During the last six-year period for which comparative figures are available, severance taxes paid to the state for the privilege of taking natural resources from the ground provided Louisiana with $383,383,900 in revenue, compared with $22,425,343 from all local sources.

Gulf Interstate to Add 405 Miles of Loop Lines

Gulf Interstate Gas Company recently has been granted Federal Power Commission authorization to construct 350 miles of 30-inch and 55 miles of 24-inch loop lines to add to its present gas system in Louisiana, Mississippi, Tennessee and Kentucky.

The $51 million project will increase capacity of the system from 575 to 666.1 Mmcf per day to serve United Fuel Gas Company of Charleston, W. Va.

The project includes 59.7 miles of 30-inch to be constructed in Kentucky; 111.2 miles of 30-inch to be added in Tennessee; 149.1 miles of 30-inch to be laid in Mississippi; and 30.7 miles of 30-inch and 55 miles of 24-inch in Louisiana.

Twelve loop lines will be constructed to feed 10 of the 11 existing stations in the system which extends through five states. Construction will begin in the early summer.

Two expansion projects by Gulf Interstate in 1957 raised the daily capacity 174 Mmcf with additions of 88,500 horsepower in ten main line stations; a 300 hp compressor station at East Mud Lake field in Cameron, La., and ten miles of loop line from Erath field, all at a cost of $25 million.

Other facilities constructed include 8.7 miles of various diameter field lines in Acadia and Vermilion, La., and small gathering lines and measuring stations to connect new supplies of gas for United Fuel Gas Company.

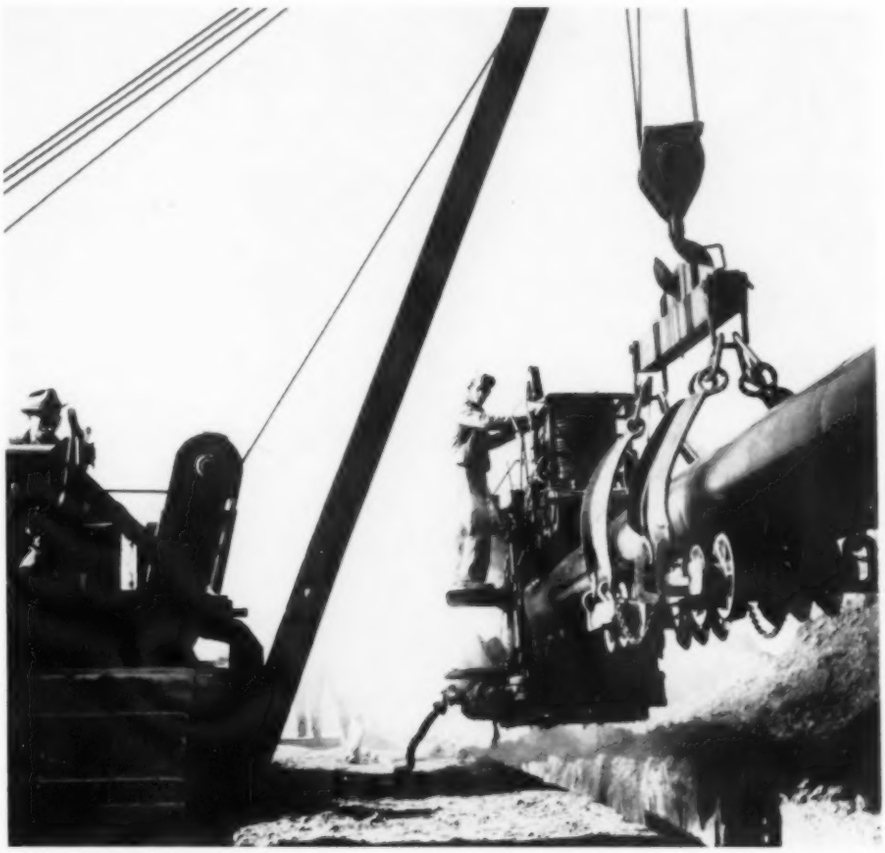
Gas Rate Increase Approved For Texas Gas Transmission

Texas Gas Transmission Corporation recently received Federal Power Commission approval to increase its gas rates, according to President W. L. Elmer.

This is the first rate increase reported since the Memphis decision.

"The increase resulted from long negotiations with the company's customers, and the subsequent agreement by the customers to the new rates," the company president said.

Fifty-five utility customers in Arkansas, Illinois, Indiana, Kentucky, Tennessee, Louisiana, Mississippi and Ohio come under the rate increase.



Transcontinental Completes Lateral Line

Coating, wrapping and lowering-in of a segment of Transcontinental lateral line near Goliad, Texas. Transco is completing a 151-mile, 24-inch pipe line to connect its three-county system of Frio, LaSalle and McMullen to its compressor station at Wharton, Texas. Gas from the three-county system presently moves through the Ike West lateral line to the main line near Sinton, Texas.

Memphis Decision Causes Postponement Of $182 Million Beatrice Gas Project

Colorado Interstate Gas Company, Natural Gas Pipeline Company and Pacific Northwest Pipeline Corporation, as a result of the 'Memphis decision,' have announced postponement of the joint Beatrice expansion project.

The $182 million program planned by the three companies includes construction of over 1100 miles of pipe lines to provide more gas in the Rocky Mountain area and the Midwest.

Delivery of pipe and other materials necessary for Beatrice construction have been deferred until the first part of 1959, according to Natural Gas Pipeline Company President George Garver.

However, the Beatrice project, which would add 485 Mmcf of gas per day to the Chicago area, will be "kept on the track," and the companies are determined ". . . to proceed with construction at the earliest possible date . . .." Garver said.

Natural Gas Pipeline Company has already undertaken to secure agreements with customers on rate increases since March, 1955, and others concerning the immediate future.

Biggest portion of construction work in the Beatrice project is planned by Colorado Interstate; that company alone would build over 700 miles of pipe lines and install better than 60,000 horsepower in station additions.

Colorado Interstate's project would include 345 miles, 30-inch line from Kit Carson, Colo., to Beatrice, Neb.; 50 miles, 22-inch from Oklahoma's Mocane field to connect with its sys-

FOR JOBS THAT ARE ROUGH, TOUGH AND DIRTY, R. H. FULTON DEPENDS ON CAT* DIESEL POWER

Name your obstacle. Chances are R. H. Fulton & Co. found it, pushing a 30-inch line across the Mojave Desert and desolate areas of California this past year. They also found it in laying a 34-inch line across New Mexico and Arizona.

There was unexpected rock. Unseasonable high winds to hold up welding and painting, and to make the maintenance of a firm ditch difficult. River crossings. Rugged mountainous terrain.

But pipe was lowered in on schedule. Because both spreads working the job were powered by sturdy, dependable Caterpillar* Diesels.

For instance, there were five Cat Twin Arc-Welders. They helped make up time lost to high winds in the desert. Welding crews hit a one-day peak of 16,300 feet. But you'd expect it. These twin arc-welders were engineered to perform under rugged conditions. They move fast because they're light and compact.

And their four-cycle diesels can idle all day on inexpensive No. 2 furnace oil—without fouling! Each unit has two sets of controls to allow operators to weld at different voltages and amperages at the same time. The generators can be paralleled into a 600-ampere generator for automatic welding. You increase production without increasing maintenance.

There were other key Caterpillar Diesels on the job in ditchers, cranes and back hoes. They are

FIVE CAT TWIN ARC-WELDERS helped Fulton welding crews set a brisk pace in spite of unseasonable high winds in the desert. Three of the welders are pulled by a D7 while two others are mounted on it.

ENGINE POWER BY CATERPILLAR

tough, heavy-duty engines designed for rugged service wherever the pipe takes you. They require no pampering to give you a long, productive life, because they're built to run under extreme conditions without breakdown.

Ask your Caterpillar Dealer. He's waiting to show you a complete line of engines from 65 HP to 650 HP (maximum output capacity). And high production twin arc-welders, as well as electric sets from 30 KW up to 350 KW (continuous duty). Have him show you the unit that can do the best job for you.

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

*Caterpillar and Cat are Registered Trade marks of Caterpillar Tractor Co.

UNEXPECTED ROCK, 9 to 24 inches below the surface, is overcome by using a D9 equipped with a giant Kelly ripper to break trail for a Cleveland ditcher powered by a Caterpillar D339 Diesel. In this area where 241 miles of 30-inch pipe is being laid for El Paso Natural Gas Co., daily average was 10,000 feet.

Under-the-hide feature typical of quality in Cat Engines

Cylinder liners: full-length, wet-type liners in all Cat Engines give more efficient heat transfer—are low cost, easy to replace. Direct contact of liner and coolant means you can be sure of long liner and ring life.

Dept. P12, Engine Division
CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

Send me more information about Caterpillar Diesel Engines. I have checked the proper box to guide your selection of material.

- ☐ I would like detailed information, as I may be in the market for a Cat Diesel Engine or Electric Set. I understand I am under no obligation.
- ☐ I am interested in learning more about these engines.

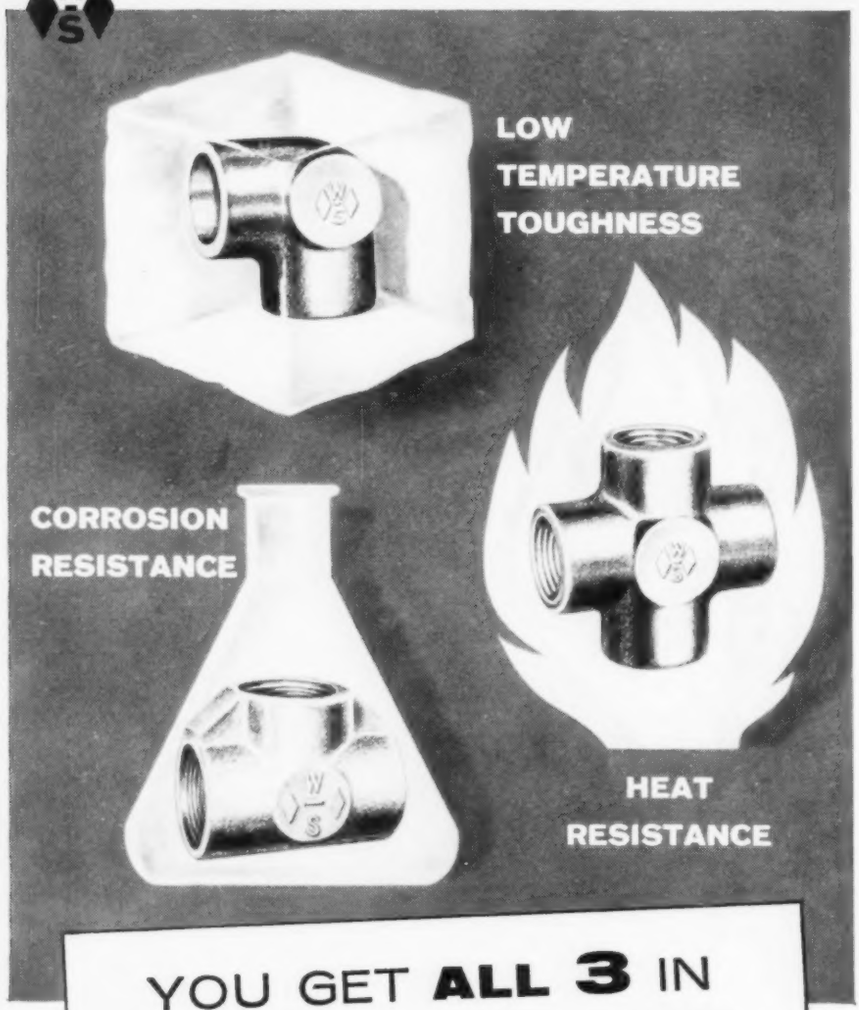
Name_____

Company_____

Address_____

City_____ Zone____ State_____

THE DOUBLE DIAMOND ASSURES DOUBLE VALUE



YOU GET **ALL 3** IN
W-S 150 lb. STAINLESS
STEEL FITTINGS

When corrosion is a troublesome factor in processing—at high temperatures or low—specify W-S 150 lb. Stainless Steel Fittings and eliminate a major cause for piping equipment failure. W-S 150 lb. fittings are available in stainless steel types 304 and 316...with screw ends or welding sockets...in sizes ⅛" to 4"...and as elbows, tees, crosses, couplings, half couplings, reducers, caps, plugs, bushings and unions.

Triple-service W-S fittings of this type are lightweight and exceptionally strong. They're your safeguard in petroleum, chemical, petrochemical, food and other process operations.

For technical information, write today for Bulletin S-3.

WORKING UNDER PRESSURE? W-S HAS A FITTING ANSWER. W-S manufactures a full range of high quality drop forged fittings, unions and couplets... in carbon, stainless and alloy steels. For full information about these products, or for your commercial forging and die casting requirements, write to: Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

FORGE AND FITTINGS DIVISION

tem at Hooker, Okla.; 100 miles, 24-inch, from its Springfield station to Pueblo, Colo.; and 215 miles, 26-34-inch, transmission loop lines from Texas Panhandle area to Kit Carson Colo.

Natural Gas Pipeline Company would construct 415 miles, 36-inch loop lines between Beatrice and Joliet Ill. A 52-mile section from Joliet to Chicago would be built by Chicago District Pipeline Company.

Under the proposal before the Federal Power Commission, Pacific Northwest would install an additional 22,500 hp in existing compressor stations to double its 177.7 Mmcf per day deliveries to Colorado Interstate.

Construction Near on Sahara 300-Mile Crude Oil Line

Pipe line developments in the Saharan oil activity have been moving fast during recent weeks. A section of 6-inch line to a railhead at Touggourt began initial operations despite threatened rebel activity by Algerian nationalists.

Entrepose Co. of Paris announced that it has a contract to construct a 300-mile, 24-inch crude line to the Mediterranean port of Bougie. Ste. Parisienne pour Industrie Electrique holds the contract jointly with Entrepose Co. (Pipe Line Industry, January, Page 78).

The Sahara line will be owned and operated by Cie Francaise de Petrole (Algeria) and Ste. Nationale de Recherche et d'Exploitation de Petroles en Algerie (SN Repal).

J. L. Guyot, president of Entrepose Co., says engineering studies and surveys are being made at the present. Construction is to begin in the fall, and the line will be completed in 1959.

Two pumping stations will provide about 100,000 barrels per day capacity with the ultimate potential capacity about 300,000 b/d.

Meanwhile Bennie Bender, a Shreveport, La. promoter, claims negotiations were underway with the French government on a $40 million project to construct an 18-inch line extending from Hassi-Messaoud to Tripoli on the Mediterranean.

Bender, who has registered the company name Afrique du Nord Development Ste., proposes to construct a line running from Hassi-Messaoud to Edjele through Libya to Tripoli.

In the Shreveport oil man's proposal four pump stations will be built mak-

ing the initial capacity 100,000 barrels per day.

Bender stated that his company will operate the line under a mortgage agreement with the title reverting to the French Government when the line is paid out.

Lublin & McGauhay will do the over-all engineering for Bender's firm and the line will be completed within a year.

Hassi-Messaoud oil is now being carried by a 112 mile, 6-inch line extending to Touggourt. From there it is transported by tank cars to the Mediterranean port at Philippeville.

Canadian Contractors To Convene in Victoria

Pipe Line Contractors' Association of Canada will hold its fourth annual convention at the Empress Hotel in Victoria, February 20-22.

Over 400 delegates from Canada and the U. S. are expected to attend the three-day meet. Two papers prepared by the association will be presented the opening day. The papers are concerned with safety and standardization of equipment rental rates.

Speakers to be featured include General James Doolittle, of Shell Oil Company, who will speak on "Oil and Nuclear Fission," Dr. William Campbell, of Atomic Energy of Canada Ltd., to talk on "Present Nuclear Development Program in Canada and Its Probable Course in Future Application," and J. Lance Rumble, General Motors Products of Canada Ltd.

Natural Gas Pipeline Co. Completes 350 Mile Gas Line

Natural Gas Pipeline Company of America has completed its 350-mile gas line from Jack and Wise counties, Texas, to its main line near Fritch, Texas.

The extension line ties into Natural Gas Company's 2260-mile line to the Chicago area and will provide an additional 100 Mmcf of gas daily to the Midwest.

The line consists of 90 miles of 20-inch and 260 miles of 26-inch. The project, which also included 135 miles of gathering lines, 4 to 20-inch, cost $32 million.

Contractors for the system include Fulton & Brodie, Inc., Pittsburg Des Moines Steel Company, Eastern Pipeline Contractors, H. B. Zachry Company and River Construction Company.

Contracts Awarded on 491-Mile Section Of Alberta to Montreal Gas Pipe Line

Contracts have been awarded on the last 491-mile segment of Trans-Canada's 2294 mile gas line from Alberta to Montreal.

This portion of the line extends from Kapuskasing, Ont., to Toronto and will be under construction early in the spring.

Northern Ontario Pipe Line Crown Corporation recently let contracts on the 367-mile section from Port Arthur to Kapsukasing.

Successful bidders are Grayco Constructors, Inc., 81.9 miles; Majestic Contractors, Ltd., 83.1 miles; Dutton-Williams Brothers, Ltd., 47.4 miles; Morrison-Shivers, Ltd., 62.1 miles; H. C. Price Company and Poole Construction Company, 62.8 miles and Oklahoma Pipe Line Contractors, 91.6 miles.

Thirty-inch pipe will be used for the line which will complete the $384 million project.

Dependability

an important consideration when you select a Pipe Line Contractor

Houston CONTRACTING COMPANY
GENERAL CONTRACTORS
Laurence H. Favrot • R. P. Gregory • Geo. A. Peterkin

OIL • GAS
GASOLINE
WATER PIPE LINES

2807 BUFFALO SPEEDWAY
HOUSTON 6, TEXAS

For more data on advertised products, use Readers' Service Cards, last page.

PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

American Louisiana Pipe Line Co., Detroit, Mich., 12.2 miles, 12 and 16-inch, gas, lines and facilities to connect North Holly Beach Field and Second Bayou Field, Cameron Parish, La. with its existing facilities, $1.4 million, before FPC.

Cherokee Pipe Line Company, Ponca City, Oklahoma, 78 miles, 12-inch, products, Ponca City to Glenpool terminal, Tulsa, approved.

Chicago District Pipeline Company, 52 miles, 30-36 inch, gas, from Natural Gas' proposed line at Joliet to Chicago, $13 million, temporary FPC authorization.

Cities Service Gas Co., Oklahoma City, 116 miles, gas, facilities in Kansas and Oklahoma and pipe lines in Kansas, $11.4 million, authorized.

41 miles, 30-inch from Verdigris River to the Petrolia compressor station; 33 miles, 30-inch between the Petrolia and Walda compressor stations; 4 miles, 4-inch in Wilson County, Kansas, and 6 miles, 12-inch gas line in Reno County, Kansas, plus replacement of facilities in Kansas, $6.5 million, temporary FPC authorization.

Coastal States Gas Producing Co., Corpus Christi, Texas, 45-mile, gas gathering system in Bee County, Texas to connect with Texas Eastern's main pipe line, $1 million, planned.

Coastal Transmission Corp., Houston, 574 miles, 22-24 inch, gas, from McAllen, Texas to Baton Rouge, La. connection of Houston, Texas Gas and Oil plus 414 miles of laterals, $55 million, authorized.

Colorado Interstate Gas Co., Colorado Springs, 734 miles, 24-30 inch, gas, from Texas & Okla. Panhandle to Kit Carson, Colo., to Beatrice, Neb., plus four compressor stations, $87 million, temporary FPC authorization.

50 miles, 22 inch, gas, from Mocane area to existing system at Hooker, Okla., authorized.

Conn-Mass Pipe Line, Inc., 88 miles, 8 inch, products, from Boston to Springfield, Mass., planned.

133 miles, 16-inch, products, from Linden, N. J. to Hartford, Conn., planned.

62.2 miles, 8-inch, products, from New Haven, Conn. to Springfield, Mass., planned.

38 miles, 6-inch, products, from Waltham, Mass. to Fitchburg, Mass., planned.

Deep Rock Gas Co., Oklahoma City, 120 miles, 6-inch, LPG, from Tioga, N. D., to Canadian border, planned.

Derby Refining Co., 200 miles, 12 inch, crude, from Meade County, Kansas, to Wichita, Kansas, considered.

Eastern Shore Natural Gas Company, Salisbury, Md., 124 miles, 6 and 8-inch, gas facilities on eastern shore areas of Delaware and Maryland, $3 million, authorized.

El Paso Natural Gas Co., El Paso, 835 miles, 4-34 inch, gas, facilities in Texas, New Mexico and Arizona; 4 to 20-inch, gas, field lateral lines in Texas, New Mexico and Arizona, authorized. $162 million. Before FPC. 362 miles authorized and contracts let.

500 miles, 34-inch, gas, from Twin Falls, Idaho to California border near Las Vegas, Nev., planned.

18 miles, 12-inch, gas, loop between Good Field and East Vealmoor, Texas, temporary FPC authorization.

Emerald Pipe Line Corp., 120 miles, 6 inch, products, from Sunray, Texas, to Tucumcari, N. M., planned.

Equitable Gas Company, Pittsburgh, Penn., development of Rhodes natural gas storage pool in Lewis County, W. Va., and construction of 11.7 miles of storage pipe line and other facilities, $2,091,430, authorized.

Gillette Pipeline Co., Cheyenne, Wyo., 103 miles, crude, from Dead Horse Creek field to Casper, Wyo., planned.

Great Northern Railway, St. Paul, 400-600 miles, 12-20 inch, crude, from Williston Basin to St. Paul-Minneapolis and Duluth-Superior areas, considered.

Gulf Interstate Gas Co., Houston, 12.8 miles, 6 and 20 inch, gas, loop line in Louisiana, $730,000, authorized.

350 miles, 30-inch, and 55 miles, 24-inch, loop lines in Kentucky, Mississippi, Tennessee, and Louisiana, $50 million, authorization.

Harry Bass & Sons, Inc., Dallas, pipe line network from well heads to compressor stations to central gasoline plant plus line to railroad in Pembina field, Alberta, $17 million, approved.

Home Gas Co., Pittsburgh, Penn., gas facilities in New York, $3.8 million, authorized.

Humble Oil & Refining Co., 250 miles, 26 or 30 inch, gas, and 200 miles, main gathering system, line of varying sizes, from southwest Texas to Houston, plus gas processing and cycling plant near Corpus Christi, $75 million, planned.

Humble Pipe Line Company, 90 miles, 16 inch, crude, from Hawley to Comyn, Texas, $3.5 million, planned.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, before FPC.

Jayhawk Pipe Line Corp., Wichita, Kansas, 242 miles, 10 and 12 inch, crude, from western Meade County to Valley Center, Kansas, $8.6 million, planned.

Katy and New York Central Railroads, 2500-mile, 10-12 inch, LPG, from Houston, Texas, to New York, Considered.

Kerr-McGee Oil Industries, Inc., 24 miles, 4 inch, gas, to connect wells with its Breton Sound production island off the Louisiana coast, authorized.

Laurel Pipe Line Co., Philadelphia, 440 miles, 14-24 inch, products, from Philadelphia to Pittsburgh to Cleveland. $50 million, contract for Susquehanna River crossing let to Pipeline Maintenance and Construction Co., Inc.

Magna Pipeline Co., 40 miles, gas, underwater line from Anacortes, Wash., to Victoria, B. C., $6 million, planned.

Manufacturers Light and Heat Co., Pittsburgh, Penn., 13.8 miles, 10 and 12 inch, gas, facilities in Ohio and West Virginia, $757,300, authorized.

Michigan Gas Storage Co., Jackson, Mich., gas, facilities in central Michigan, $2 million, authorized.

Michigan-Wisconsin Pipe Line Co., Detroit, 472 miles, 4- 24-inch, gas, main line loops and extensions in Wisconsin, Illinois, $17.6 million, before FPC, temporary authorization for a part, 47.5 miles let to G. E. T. Construction, Inc.

148 miles, 4-20 inch, gas, line to connect new gas supplies in Laverne field, Northwestern Oklahoma, planned.

Midwestern Gas Transmission Co., Houston, 2067 miles, 3-24 inch, gas, from Emerson, Manitoba, to Nashville, Tenn., $103 million, before FPC.

Mookl Chemical & Gas Corp., Tulsa, and **Missouri Transmission Corp.,** Springfield, Mo., 425 miles, 16-inch, gas, from Oklahoma City area to St. Louis, before FPC.

Natural Gas Pipe Line Co. of America, 416 miles, 36 inch, gas, loops at various points along existing line between Beatrice, Neb., and Joliet, Ill., $76.2 million, temporary FPC authorization.

New York State Natural Gas Corp., Pittsburgh, Penn., gas, facilities in New York state, $1.2 million, authorized.

North Carolina Natural Gas Corp., 630 miles, 2-16 inch, from Transco's system near Mooresville across to southeastern North Carolina, authorized.

Northern Natural Gas Co., Omaha, 167 miles, 20 inch, gas, from Farmington, Minn. to Duluth, Minn., and Superior, Wis., $12 million, before FPC.

42 miles, 10 inch, gas, from Rochester, Minn. to Winona and Goodview, Minn., $963,000, before FPC.

365 miles, gas, new facilities in Minn., Iowa, S. D., Neb., Wis., plus 1090 miles of branch line and station facilities, $65.7 million, authorization for a part. Gas facilities in Texas, Oklahoma and Kansas, $6 million, before FPC.

27.6 miles, 30-inch, gas, loop; 18.3 miles north of Beaver station in Okla., 9.3 miles north of Sunray station in Texas, $3 million, temporary FPC authorization.

Northwest Pipeline Corp., Salt Lake City, 350 miles, 6-10 inch, crude, from Four Corners area to Salt Lake City, $15 million, considered.

Ohio Fuel Gas Co., Columbus, Ohio, 56 miles, 18-24 inch, gas, Richland County, Seneca County, Sandusky County to Toledo area, $4 million, contract for 22 miles awarded to H. L. Gentry Construction Co.

33 miles, 4 to 20 inch, various counties, Ohio, $1 million, authorized.

21.8 miles, 12 and 20-inch, natural gas facilities in various counties, Ohio, $1 million, authorized.

Ohio Oil Company, Findlay, Ohio, 350 miles, 12 inch, products, from Wood River, Ill. to Chicago, 84 miles let to Panama-Williams Corp.

Pacific Gas & Electric Co., 1300 miles, gas, from Alberta, Canada to Antioch, Calif., $380 million, planned.

Pacific Northwest Pipeline Corp., Salt Lake City, 235 miles gas, gathering lines in San Juan Basin, Garmesa, Piceance Creek, and Big Piney Fields, $13.5 million, planned.

65 miles, gas, sales laterals in Washington, $1.5 million, planned.

52 miles 30" loop Big Piney, Wyoming, gathering system, $5 million, planned.

Panhandle Eastern Pipe Line Co., Kansas City, 33 miles, 16 inch, gas, Muncie, Ind., lateral, planned.

Pennsylvania Gas Co., Warren, Penn., 38 miles, 8 and 10 inch, gas, in Erie and Warren Counties, Penn., and Chautauqua County, N. Y., $2.6 million, authorized.

Permian Basin Pipeline Co., Omaha, Neb., 26.8 miles, 10 inch, gas, from a point on existing system in Pecos County, Texas, to a gasoline plant, $787,100, authorization.

Piedmont Gas Co., Hickory, N. C., 78 miles, 2-8 inch, gas, from connection with Transcontinental Gas Pipe Line to serve customers in North Carolina, $2.6 million, authorized.

Shell Pipe Line Corp., 100 miles, 18-20 inch, crude, from Shell's Southwest Pass terminal to Shell's Norco Refinery near New Orleans, $10 million, planned.

Southern Kansas Pipe Line Co., Inc., Arkansas City, Kansas, 200 miles, 6-10 inch, crude, southwestern Kansas to Arkansas City, Kansas, planned.

Southern Natural Gas Co., Birmingham, 69 miles, 24 inch loop, gas, along the east leg of the Louisiana supply system between Toca and Franklinton compressor stations; 67 miles, 26 inch loop, gas, from Franklinton to Gwinville, La., to bring gas from 12 fields on south Louisiana to main system at Gwinville, $37.5 million, before FPC.

Tennessee Gas Transmission Co., Houston, 632 miles, 24 and 30 inch, gas, from Louisiana delta to Portland, Tenn. and Coudersport, Pa. to Hamburg, N. Y., temporary FPC authorization.

264 miles loop lines in Tennessee, Kentucky, West Virginia and Pennsylvania, temporary FPC authorization.

Compressor stations in Mississippi, Tennessee, New York, Pennsylvania and additions in Tennessee, Kentucky, Ohio and Pennsylvania, $129 million, temporary FPC authorization.

Texas Eastern-Penn-Jersey Transmission Corp., Shreveport, La., 65 miles, gas, from Delmont, Penn., to Lambertville, N. J., before FPC.

24,000 compressor hp additions to existing stations, $4.4 million, temporary FPC authorization.

Texas Eastern Transmission Corp., Shreveport, La., 267 miles, 14-30 inch, gas, Louisiana, Mississippi, Pennsylvania and New Jersey, $50 million, before FPC. 59 miles, 30-inch, gas, loop additions to pipe line from Kosciusko, Miss. to Uniontown, Penn., $5.8 million, temporary FPC authorization.

96.5 miles, 30-inch, gas, between Kosciusko, Miss., and Uniontown, Penn.; 9.4 miles of supply laterals; a 10,250 hp compressor station, and 33,360 hp to existing compressor stations, $24.5 million, authorized.

Texas Eastern Transmission Corporation and Wilcox Trend Gathering System, Inc., gas, compressor stations, $4 million, authorized.

Texas Gas Gathering Corp., Shreveport, 36.6 miles, gas, gathering system in Rodney Field, Jefferson County, Miss. and from North and South Locust Ridge, Lake St. John Field in Tensas and Concordia parishes, La., $855,413, Before FPC.

Transcontinental Gas Pipeline Corp., Houston, 87 miles, 24 inch, and 56 miles, 6-10 inch, gas, gathering systems, Southeastern Louisiana, $14 million, before FPC.

202 miles, 36-inch, gas, loops, 106 miles, 30-inch, three new compressor stations totaling 24,084 hp, additions at five stations totaling 12,000 hp, 195 miles, 24 and 30-inch, gas, across Pennsylvania to Leidy Storage Field, purchase laterals of 8-20 inches in South Louisiana and offshore, and a new river crossing to serve New York, $126.8 million, before FPC.

Trans-Western Pipe Line Co., 800 miles, 30-inch, gas, Four Corners area to California, $200 million, planned.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.

95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to Bella Coola, B. C., before B. C. government.

Alaska-Yukon Refiners and Distributors, Ltd., Edmonton, Alta., 150 miles, products, serving Alaska and Yukon territory, $3.5 million, planned.

Bituminous Oil Pipeline Co., Calgary, 250 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

British Petroleum Co., New York, 60 miles, crude, from deep water tanker terminal at Milford Haven, U. K. to Llandarcy Refinery, $18 million, planned.

Burmah Oil Co., Ltd., 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, India, planned.

Canada Southern Petroleums, Ltd., Calgary, 400 miles, crude, from Peace River region of northeast British Columbia to Bella-Coola, planned.

Cie. de Recherche et d'Exploration de Petrole au Sahara, 530 miles, 16 inch, crude, Edjele field in Algeria to a port on Libyan coast, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Cuban Gas Transmission Co., 650 miles, gas, from Campeche area of Mexico across Yucatan and under Gulf of Mexico to Havana, Cuba, 120 miles would be submarine, considered.

Development and Resources Corp., 70 miles, 8 inch, gas, from Agha Jari oil field to Ahwaz, Iran, planned.

East Coast Transmission Co. (Pacific Petroleums, Ltd., Home Oil, Ltd., Canadian Homestead Oil, Ltd. and Merrill Petroleums, Ltd.), crude, from Alberta to Toronto, planned.

Elburz Oil Corp., 1000 miles, big inch, crude, from Central Iran to Alexandretta, Turkey, $450 million, planned.

Entre Nazionali Idrocarburi, Rome, Italy, crude, from Qum field in Iran to the Mediterranean Sea, considered.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Iraq Joint Venture Pipe Line, 1200 miles, 38-40 inch, crude, from head of Persian Gulf through Iraq to Turkish coast of Mediterranean, $840 million, planned.

Iranian Consortium, 50 miles, 26-28 inch, crude, from Gach Saran field to proposed terminal near Bandar Mashur, contract let to Raymond Concrete Pile Co., William Bros. Co., John Brow, Ltd., Richard Costain, Ltd., and Werks Poor and Brede Co.

22 miles, 16 inch, and 30 miles, 16 inch, crude, from Agha Jari field to Bandar Mashur, planned.

Mene Grande Oil Co., 42 miles, 16 inch, crude, from Ceuta field in Lake Maracaibo to Bachaquero terminal, $6 million, planned.

76 miles, 30 inch, from Oficiana to Puerto La Cruz, Venezuela, considered.

61 miles, 6 inch, LPG, from Anaco to Puerto La Cruz, Venezuela, considered.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

1000 miles, 38 inch, crude, from central Iran to the Turkish Mediterranean coast, considered.

Northern Utilities Co., 35 miles, 16 inch, gas, in Fremont Natrona County, Wyo., area; 8 miles, 12 inch, around Casper; 6 miles, 8 inch, from Sand Draw gas field to Beaver Creek field; 12 miles, 6 inch, from Beaver Creek field to the system servicing the Riverton-Lander area, planned.

Northwestern Utilities, Ltd., Edmonton, 75 miles, 16-inch, gas, from Pembina field to Edmonton, $3.5 million, approved.

Petroargentina, Bahia Blanca, Argentina, 370 miles, 16 inch, crude, from Newguen to Bahia Blanca, Argentina, $40 million, planned.

Petroleos Mexicanos, 108 miles, 10 inch, gas, from Gral. Escobedo to Monclova to tie into Reynosa-Monterrey gas pipe line, $9 million, planned.

108 miles, 10 inch, gas, from Gral. Escobedo to Monclova to tie into Reynosa-Monterrey gas pipe line, $9 million, planned.

600 miles, 24 inch, gas, from Pemex City to Mexico City, $50 million, planned.

38 miles, 4 inch, products, from Mexico City of Toluca, $500,000, planned.

126 miles, 4, 6 and 8 inch, products, from Mexico City to Cuernavaca and Puebla, $2.5 million, planned.

Royal Dutch Shell Co., 155 miles, 24-30 inch, crude, from German Rhineland to mouth of Rhine River, planned.

Saskatchewan Power Corp., Regina, Sask., 80 miles, gas, Hatton gas field to Success, Sask., planned.

40 miles, gas, Moose Jaw to Regina, Sask., planned.

Stanmount Pipe Line Co., 140 miles, 10 inch, crude, Cayiga and Beaver Lake fields, N. D., to connect with Interprovincial Pipe Line, planned.

Sturgeon Pipe Line Co., 100 miles, 12-inch, Sturgeon Lake field to Trans-Mountain system, $6.5 million, planned.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

83 miles, 10-inch, gas, from Rohri section headquarters of Sui-Karachi line to main Multan line on East bank of Indus in the Bhung vicinity, Pakistan, planned.

Trans-Canada Pipe Lines, Ltd., Calgary Alta, 2294 miles, 20, 24, 30, 34-inch gas, from Alberta to Eastern Canada, $378 million; 1342 miles completed, 367 miles under construction, contracts let to Grayco Contractors, Inc., Majestic Contractors, Ltd., Dutton-Williams Brothers, Ltd., Morrison-Shivers, Ltd., H. C. Price Co. and Poole Construction Co., and Oklahoma Pipe Line Contractors on last 491 miles.

Trans-Europe Pipe Line, 700 miles, 30 inch, main trunk, crude, from Mediterranean to northern Europe, considered.

Trans-Mountain Oil Pipe Line Co., 100 miles, loops near Kamloops, B. C. and Edson, Alta. plus pump station, tank farm and three temporary stations, $40 million, 50 miles let to Dutton-Williams Bros.

Westcoast Transmission Company, Ltd., 174 miles, 30-inch, gas, Savanna Creek gas field, Alberta, to British Columbian border, $45 million, planned.

650 miles, crude, from Peace River area to Vancouver, $100 million, planned.

Winnipeg and Central Gas Co., Winnipeg, Mant., 450 miles, 4-8 inch, LPG, from Tioga, N. D. to Winnipeg, Canada, $20 million, planned.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

281 miles, 12¾ inch, crude, Pichanal to San Miguel Tucuman to Techint, S. A., planned.

Pacific Northwest, Westcoast Consider 200-Mile Gas Line

Construction of a 200-mile, gas pipe line from Spokane, Wash., to Savannah Creek, Alberta, is being considered by Pacific Northwest Pipeline Company and Westcoast Transmission Company.

The line would furnish El Paso Natural Gas Company 150 Mmcf of gas per day which will be delivered to California. El Paso has already made plans for a 500-mile, 34-inch line to transport gas from Pacific Northwest main line at Twin Falls, Idaho to the border of California.

Pacific Northwest, a subsidiary of El Paso, would build the first section extending its gas line from Spokane to Kingsgate, Alberta. Westcoast Transmission would construct the final portion to Savannah Creek.

El Paso has two other sources of gas to supply its project in California. Gas may be taken from Pacific Northwest's line extending into Alberta, or it may be secured from reserves in the Rocky Mountain area.

El Paso's long range plans call for delivery of 400 Mmcf of gas daily to Southern California utilities by late 1959.

A high-performance crawler excavator

the ALLEN model C16

This British-built ½ cu. yd. machine is one of the latest in the ALLEN range of HIGH QUALITY excavators.

It can swing, hoist, and travel all at the same time, thus reducing working time on many jobs. Smooth, air-controlled clutches give fast working and a high output comparable with many larger machines.

Write for full particulars.

Air-controlled segmental clutches for light handling and easy replacement. All drums and shafts on ball bearings. Power unit—the Gardner 4 LW oil engine. Two forward travel speeds. Can be equipped as crane, clamshell, dragline, shovel or trench hoe.

JOHN ALLEN & SONS (OXFORD) LTD
COWLEY OXFORD ENGLAND

CLEVELAND TRENCHERS AND BACKFILLERS

There's a Cleveland to make you money on every trenching and backfilling job, large or small. Contact your local distributor now.

Good Everywhere

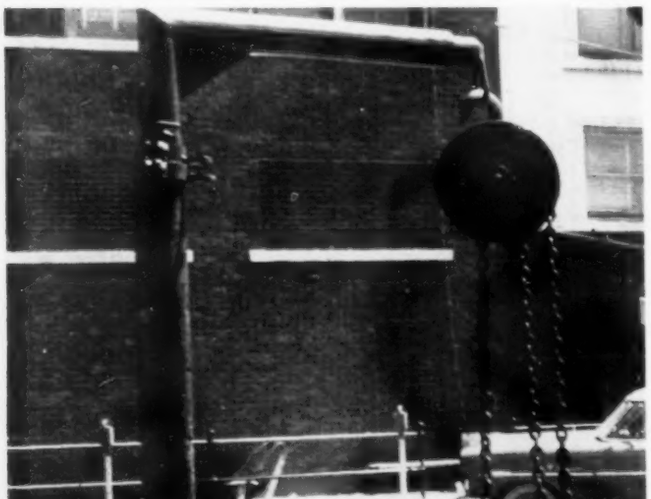
THE CLEVELAND TRENCHER CO.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texa



Swinging Arm Supporting Hoist Aids in Loading Truck

A swinging arm supporting a chain hoist can be mounted on the rear of a truck and aid in loading heavy objects. With the arrangement shown, the hoist is located out of the way and will not take up usable space on the truck bed. When not in use it can be swung back next to the bed rail.

The vertical supporting column is a 4-foot length of 4-inch pipe, with a footing made of angle iron welded at right angles and braced with short lengths of small diameter pipe. A stamp clamp at the top of the vertical column acts as a supporting shoulder for the vertical section of the swinging arm. The swinging arm is made of 3-inch diameter pipe and telescopes inside the larger pipe.

A triangular brace, made of ¼-inch steel is welded into place between the horizontal arm and the vertical section to provide strength and rigidity. A steel loop welded to a length of 2-inch pipe is inserted into the end of the horizontal arm and securely welded into place. A chain hoist is supported on the end of the swinging arm.

Relief Valves Placed Near Ground For Easy Checking

Where several pipe line scrubbers are placed in a row it is a problem to keep the relief valves checked and serviced when they are placed on top of vessels out of easy reach.

Since large lines are used to carry the gas away from the tops of the towers, a more convenient place can be found near the ground where the pipes dog-leg into the headers. It is then a simple matter to run the outlet lines from the valves to the top of the tower to dissipate any escaping gas. No valves are placed between the open valves and the top of the scrubbers so that the relief valves always carry the scrubber pressure.

By using the flanged relief valves the piping is arranged so that any tower can be taken out of service for a few moments and the relief valves replaced without going to the top of the tower. The adjustments for the popping pressure can be made in a convenient position with a glance at the indicating gage on the side of the vessel.

Bypass Around Main Valve Provides Fine Adjustment

Where temporary boiler installations have manual control on the feed water make-up, a bypass around the main valve used to fill the boiler will allow fine adjustment. This allows the main valve to be opened up when the boiler is being filled after it has been blown down. Then when it is closed, the small needle valve comes in to play for keeping the boiler at a constant level while the steam is being used for power and heat.

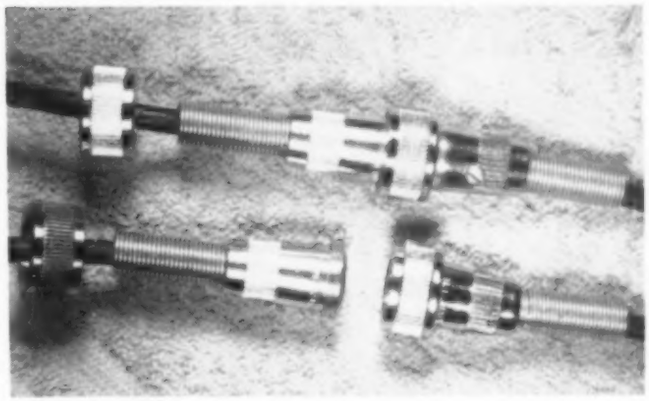
The assembly is made up with unions on each side and nipples looking into the feedwater line on each side of the main cutoff valve. Holes are then burned into these spots and the nipples welded in place with the unions made up. If it is necessary to repair or replace the valve, it is easily removed by breaking the unions. Where automatic controls are installed, they can be installed on the same bypass so that the automatic controls, or manual control can be used with the main valve closed.

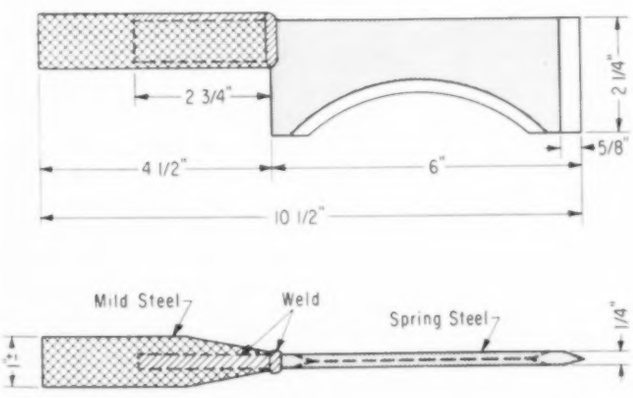
Multi-Purpose Test Leads Solve Connection Problems

Due to many types of connectors used in communication equipment, repairmen find it necessary to carry a large bundle of test leads. In making connection between test instruments and the equipment, sometimes as many as four test leads must be connected together to obtain the right connections. The various leads were in assorted lengths and wire sizes, making them become tangled easily and difficult to find.

To solve this problem, a search was made for a single connector, which, when used with adapters, would fit any connection. A set of leads was made using a microphone connector on one end. This is a female connector, but can be quickly converted to a male by screwing the knurled cap back over the body. With the microphone connector on one end, any connector needed can be installed on the other end. By using the proper two test leads, every connector could be matched with any other connector, or to itself. Installing microphone connectors on both ends of some leads makes it possible to easily install extensions to any of the test leads.

The total number of leads required can be reduced with this arrangement and through use of adapters to fit the microphone plug.

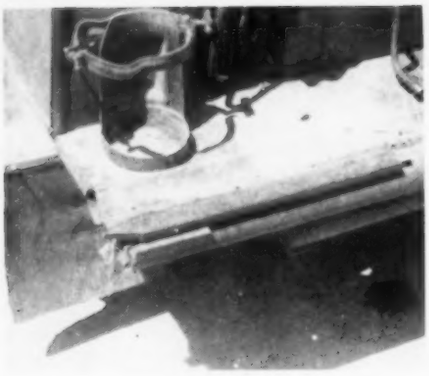




Handy Tool Bevels Coating

To prevent ragged ends of yard-coated pipe acting as a wick when the field joint is made, the coating should be beveled properly. This permits a lapping of the felt at the joint and provides for a good bond between the yard wrapping and the field joint. A smooth bevel is difficult and time consuming to obtain using a linoleum knife.

The tool illustrated here is specially designed for this service. The cutting edge is made of spring steel which is cut in an arc to allow easy contact around the circumference of the pipe. A handle of mild steel is welded to the knife blade. Using this inexpensive tool, smooth bevels can be made easily on yard-coated pipe.



Pointed Rail Serves as Anvil for Welder

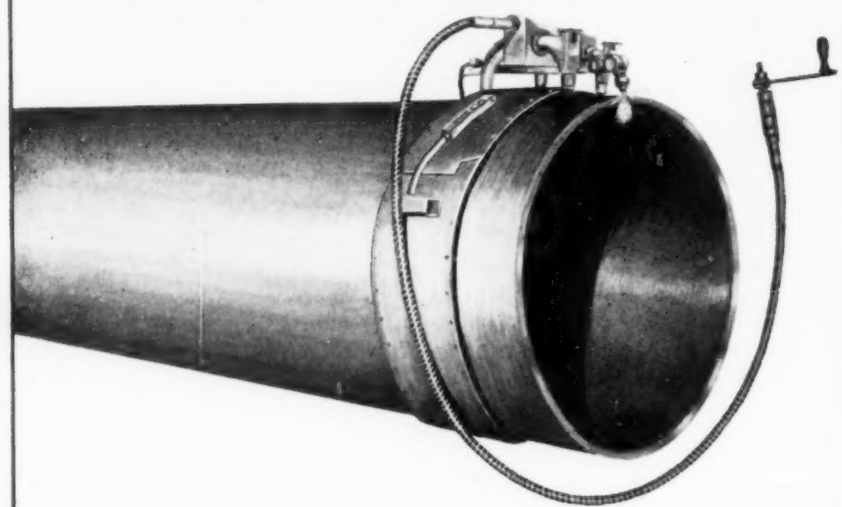
A 30-inch length of 60-pound yard rail, with one end of the rail ball pointed, and a piece cut out of the web for a distance of four inches from the point, makes a practical anvil for a welder. The end of the rail was cut with a cutting torch, and the rough edges of the cut were smoothed on a grinding wheel.

A slot, slightly wider than the web of the rail was cut in the top of the roll-over pipe on the back end of the truck bed. Small strips of angle iron about ten inches long were welded on the outside of the slot in the roll-over pipe near its outer end, to hold the pointed end of the rail anvil in place.

When in use, the rail anvil can be pulled out a few inches from the end of the roll-over pipe. When not in use, it will slide back in the slot and is out of the way.

BEVELS 6" PIPE

BEVELS 48" PIPE



C-R-C IMCO BEVELERS fit all pipe sizes 6" to 48" O. D., cut perfect bevels, and out-of-round pipe, too. Single lightweight unit does work of several, costs you less to buy and use.

ONE BEVELING KIT FOR ALL YOUR JOBS!

For additional information see page 108, Pipeline Composite Catalog.

The CRC IMCO Pipe Beveling Kit contains a complete range of bands for beveling a variety of pipe sizes. With this convenient selection of sizes, the operator need only make one trip to handle all pipe beveling requirements including back beveling. The sturdy steel case and number of bands are optional.

CRC

CRUTCHER • ROLFS • CUMMINGS, INC.

HOUSTON, TEXAS
P. O. Box 2073 UNderwood 4-6391

FARMINGTON, NEW MEXICO
P. O. Box 1207 DAvis 5-5523

IN CANADA: Canadian Equipment Sales & Service Co.
7310 99th St., Edmonton, Alberta, Canada

Relief Valve Support Stand Provides Easy Inspection

Where relief valves are run to a point outside the station area, they are sometimes put at a point where it is difficult to keep them inspected and out of the weather. One operator uses the support stand for a ladder and installs a crow's nest on top so that the valve can easily be reached for inspection and adjustment.

The support is made from four-inch pipe with the valve installed and adjusted in the shop and a cover fitted on to keep out the elements. A flanged nipple is then welded on the side to match the companion flange from the relief line. At the bottom of the riser, a connection for a drain is installed to keep condensation from reaching the valve. The riser is then set in concrete and flanged up to the relief line. The ladder is made from short pieces of ¾-inch rods having first been installed at the shop.

With one of these devices installed on all the relief lines, it is a simple matter for the operator to make periodic checks and adjustments.

World's First Nuclear-Powered Surface Ship will have MIDWEST Welding Elbows

U. S. Navy's guided missile, nuclear-powered cruiser "Long Beach"

OFFICIAL U. S. NAVY PHOTOGRAPH

Special Fittings are "ROUTINE" for Midwest

Stainless Steel
S.R. 102° Elbow
with tangent on one end.

Stainless Clad
S.R. 39° Elbow
with tangent on one end.

Stainless Steel
S.R. 90° Elbow
with tangent on both ends.

Special Elbows (dimensions, tangents, wall thicknesses and materials) are easily provided by the exclusive and flexible Midwest method. Elbows are available in any material that can be secured as plate, which also means better delivery. Closer tolerances are inherent in the Midwest process. Quality control always exceeds Code requirements.

Shown here are three of the special stainless steel and stainless-clad elbows made by Midwest for the "U.S.S. Long Beach". All reactor coolant piping must meet extremely rigid specifications because of the difficult service. Special quality controls, such as ultrasonic testing, intergranular corrosion tests, dye checking, radiography, and ring flattening tests were used one or more times at various stages of manufacture from the raw material to the finished fittings. Special quality standards for soundness of metal, "water clear" welds, dimensional accuracy, and surface finish were satisfied.

The U. S. Navy's first nuclear-powered surface ship, the "Long Beach", will introduce a radically new concept in defense capabilities. She will operate offensively and independently of other forces under conditions of both nuclear and non-nuclear warfare against airborne, surface or under-sea opposition. In addition to equipment and weapons for detecting and destroying enemy submarines, she will carry the Navy's modern guided missiles.

The piping for the atomic reactors being designed and developed by the Westinghouse Electric Corporation will use a large number of special heavy wall stainless steel Midwest Welding Elbows. This is not the first atomic project for which Midwest Welding Fittings have been used. In fact, when the nuclear propulsion program first began, Midwest furnished special welding fittings for the "Nautilus" prototype installation at Arco, Idaho.

Whether or not you are concerned with nuclear power, Midwest Welding Fittings (both stock and specials) will do a better job for you. Ask your Midwest distributor or write us for Catalog 54, which tells you why.

MIDWEST PIPING COMPANY, INC.

Main Office: St. Louis 3, Missouri (P.O. Box 433)

Plants: St. Louis, Clifton, N. J. and Los Angeles

SALES OFFICES: ASHEVILLE (BOX 446, SKYLAND, N.C.) • BOSTON 27—426 FIRST ST.
CHICAGO 3—79 WEST MONROE ST. • CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE. • LOS ANGELES 33—520 ANDERSON ST.
MIAMI 34—2103 LE JEUNE RD. • NEW YORK 7—50 CHURCH ST.
PITTSBURGH 19, PA.—437 GRANT ST. • ST. LOUIS 4—1450 S. SECOND ST.
SAN FRANCISCO 11—420 MARKET ST.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

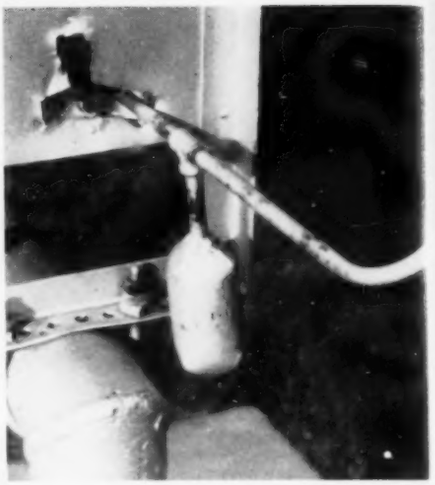
7918

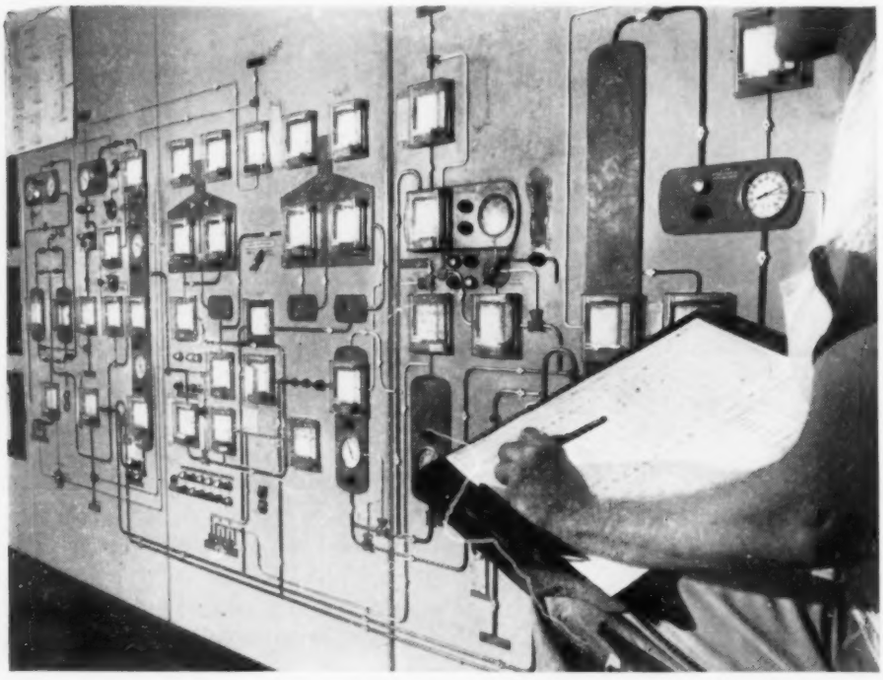
MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

Metal Bulb Serves as Trap for Mercury

An easily made metal bulb inserted in the differential pressure tube of an orifice meter, serves as a trap for the mercury which may be forced out of the bowl of the meter mechanism. When the meter is subjected to excessive surges of pressure, such as are sometimes caused by being located too close to a compressor, or if the gas is full of hydrates, to the extent that the mercury might be blown out of the meter, loss of mercury can become a problem.

With such a bulb trap located in the meter pressure tube, the mercury is readily recoverable. Without the trap, the mercury is blown back into the channel of the meter run and is lost. Since mercury is expensive, the bulb serves a useful purpose and does not interfere with the normal operation of the meter.





To keep 'em reading right . . .

Come to Kemp

Get increased precision and longer life by protecting your air-operated instruments with Kemp Oriad Dryers. Kemp dryers clean and desiccate air supplies to stop condensation, corrosion and jamming.

In operations across the country, Kemp Oriad Dryers are giving dependable performance, year after year, with only routine care and maintenance.

Your Kemp Representative will show you how *your* instruments can get maximum protection at minimum cost. Or write us direct for Bulletins D-102 and D-103. The C. M. Kemp Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.

KEMP OF BALTIMORE

Available in all sizes for automatic, semi-automatic, or manual operation. Steam or electric reactivation.

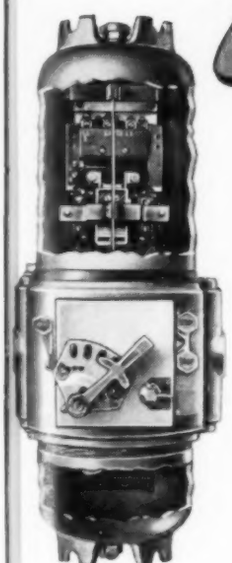
Portable Tool Rack Aids In Cleaning and Storage

Heavy tools used in pipe line construction and maintenance work present a problem in storage and cleaning. Many times when they are returned from a job they are covered with oil and dirt.

With this convenient storage rack there is a place for every tool. Being portable, the rack can be moved to the gang truck, and the tools transferred directly. Before being returned to the warehouse, the tools can be steam cleaned and washed down. When in the warehouse, the rack can be pushed into an out-of-the-way place.

Constructed from scrap material, space can be provided for whatever tools are to be stored. Use of this rack is an easy way to keep tools clean and in their proper place.

CROUSE-HINDS
Condulet* motor controls
Occupy Less Space!



48 Explosion-Proof Combination Motor Starters and Circuit Breakers . . . *in a 25 ft. x 6 ft. Area!*

Crouse-Hinds Condulet* Type EPC Motor Starters and Circuit Breakers are explosion-proof, dust-tight (dust-ignition-proof) and weather-resistant (raintight).

Lightweight cast aluminum construction for easy installation without use of lifting equipment.

Seven Conduit entrances simplify installation.

Built-in push button stations and selector switches are available.

Starter sizes 0 to 5. Circuit breakers 50 to 600-amp. frame sizes.

In the installation shown above, 48 Crouse-Hinds Condulet* Type EPC combination motor starters and circuit breakers are compactly arranged in four racks.

If necessary, the 25 ft. x 6 ft. area used could have been cut in half by installing the Condulet motor controls in two tiers. Or, *twice* as many Condulet controls could have been installed in the same area, if required.

The *vertical design* of Crouse-Hinds motor starters, circuit breakers and combinations allows them to be installed only ¼" apart. This compactness produces savings in the construction of steel mounting racks, and in the use of premium floor space.

● **For help in solving a space problem, see your Crouse-Hinds distributor . . . or call the nearest Office listed below**

*Registered

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

CROUSE-HINDS COMPANY

Main Office and Factory: Syracuse, N. Y.

Offices: Tyler, Texas; Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Los Angeles, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Washington. RESIDENT REPRESENTATIVES: Albany, Arroyo Grande, Atlanta, Charleston, W. Va., Cincinnati, Cleveland, Columbia, S. C., Dayton, Fresno, Harrisburg, Pa., Reading, Pa., Richmond, Va., Shreveport. Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

What's Happening

among MEN in the INDUSTRY

R. P. Gregory

J. H. Williams

J. W. Sharman

E. G. Morrison

Pipe Line Contractors Association officers elected at the January convention in Boca Raton, Fla., are **R. P. Gregory**, Houston Contracting Co., president; **John H. Williams**, Williams Brothers, Tulsa, first vice president; **James W. Sharman**, Sharman, Allen, Gay & Taylor, Houston, second vice president; and **E. G. Morrison**, Western Pipeline Incorporated, Austin, treasurer.

•

E. V. Bond, Jr., of Fort Worth is the new superintendent of **Truckline Gas Company's** production operations.

E. V. Bond, Jr.

He has worked as an oil field hand and as a gravity crew member and rose to the position of geophysical survey crew party chief with the Gravity Meter Exploration Company. In 1945 he joined a drilling mud service company as an engineer, operating throughout Texas and Louisiana areas. He joined Southern Production Company in 1948 as a district engineer, progressing to district and general superintendent posts.

•

A. J. Le Blanc has been promoted to coordinating engineer by **Pipe Line Technologists, Inc.** of Houston. He joined the organization in 1952.

George F. Hall, Jr., is the new assistant general traffic manager of **Cities Service Oil Company's** Supply and Distribution division and will headquarter at Bartlesville, Okla. Other staff changes for Cities Service affect **Murray G. Wells**, new assistant chief geologist of the company who succeeds **E. W. Dissler**, new resident manager and vice president of **Canada-Cities Service Petroleum Corp.** Wells is succeeded by **Barron Housel** who has been assistant superintendent of the Land department. **Mark Payton** is replacing Housel. **Charles V. Mahaffey** is a new district geologist at Roswell, N. M., for Cities Service. Mahaffey succeeds **M. F. Kennedy** who has taken a foreign assignment with another Cities Service company.

•

W. S. Godwin, manager of **Texas Gas Transmission Corporation's** Clarksdale, Miss., compressor station the past seven years, has been appointed superintendent of the Tennessee-Mississippi division of the company's Compressor department.

W. S. Godwin

In his new position Godwin will have supervision over Texas Gas compressor stations at Kenton and Covington, Tenn., Lake Cormorant, Lula, Clarksdale, Denoit and Greenville, Miss.

Godwin will be located at Texas Gas division offices at Memphis, Tenn., and succeeds T. L. McWilliams, who was recently made assistant superintendent of the entire Texas Gas Compressor department.

T. C. Tatum, manager since 1945 of the station at Lula, Miss., succeeds Godwin as manager of the Clarksdale station, and **J. C. Stewart** replaces Tatum as Lula's manager.

•

Eskil I. Bjork, board chairman of **Peoples Gas Light & Coke Company** of Chicago, has been elected to a three-year term on the board. Elected to fill vacancies on the board which expire in 1959 are **Gerald T. Mullin**, president of **Minneapolis Gas Company** of Minneapolis, Minn., and **R. A. Puryear, Jr.**, president of **Alabama Gas Company** of Birmingham, Ala.

•

Reelected to three-year terms are **F. M. Banks**, president of Southern California Gas Company of Los Angeles, Calif.; **E. J. Boothby**, president of Washington Gas Light Company of Washington, D. C.; **James D. Cunningham**, president of Republic Flow Meters Company of Chicago; **E. H. Eacker**, president of Boston Gas Company of Boston. Also **Robert A. Hornby**, president of Pacific Lighting Corporation of San Francisco; **George T. Nafl** president of Texas Eastern Transmission Corporation of Shreveport, La.; **J. Theodore Wolfe**, president of Baltimore Gas and Electric Company of Baltimore, Md. and **George S. Young**, president of Columbia Gas System, Inc., of New York.

•

Howard D. Hartough is the new general manager of the Girler Catalyst department of **National Cylinder Gas Company.**

H. D. Hartough

Hartough will be in charge of all phases of research, development, production and application of catalysts manufactured in the firm's Louisville, Ky., plant.

Since 1954 Hartough has been assistant to the general manager of the **Houdry Process Corporation** of Philadelphia, where he was in charge of market development. He was previously employed in research work at **Socony-Mobil Research Laboratories** and at the **Hercules Powder Company.**

•

John C. Bolinger, Jr., has been elected president and director of **East Tennessee Natural Gas Company** of Knoxville, Tenn.

Bolinger had been assistant to the president of Mississippi River Fuel Corporation and vice president and director of subsidiary operations prior to his election by East Tennessee.

•

William M. Osborn, Gilbert C. Tompson and **John T. Miller** have announced the formation of a partnership as petroleum consultants offering geological, land and engineering services under the firm name of **Osborn, Miller & Tompson.**

Offices are located at the Ezell Building, Midland, Texas.

•

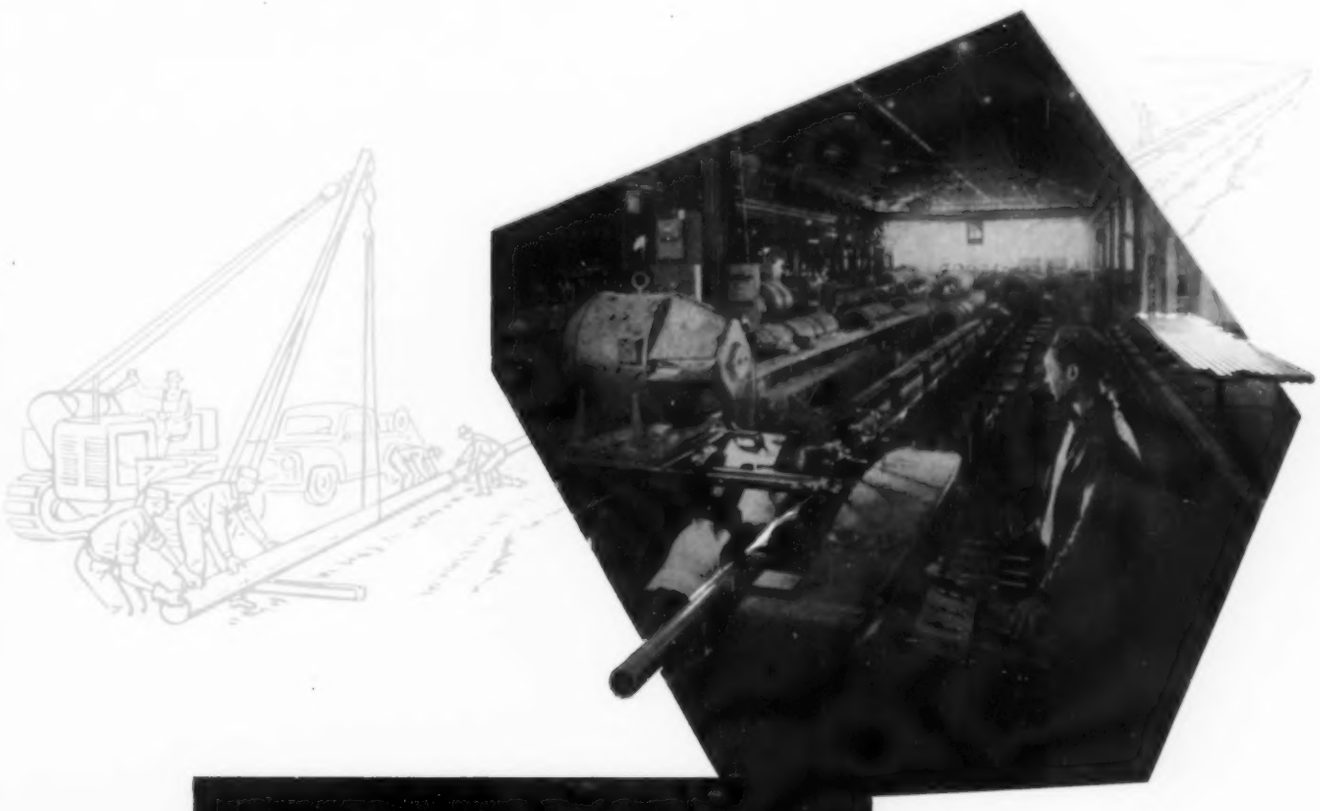
Clark H. Craft is the new chief engineer and **Ralph W. Howe** is new superintendent of measurement for **Texas Eastern Transmission Corporation's** Little Big Inch division.

Craft will supervise all engineer and planning activities of the division, and Howe will be in charge of measuring and gaging petroleum products handled by the division.

Another Little Big Inch division appointment concerns **Sie L. Creech** who has

Acme-Newport Steel

SPECIALISTS IN 4" and 6" ELECTRIC WELD LINE PIPE*



As a basic steel producer, Acme-Newport controls every process in the manufacture of the steel itself, as well as pipe formation, welding and hydrostatic testing. This tough, long-lasting pipe is perfectly round and of uniform wall thickness, and exceeds every API and ASTM specification. On the job it lines up properly, is easy to bend, weld and install, and gives uninterrupted service under high pressures. Let Acme-Newport give you more facts.

*SIZES AND WEIGHTS AVAILABLE

O.D.	Wall	Wt. Per Ft.
4½	.125"	5.84
	.142"	6.61
	.156"	7.25
	.188"	8.64
	.219"	10.00
	.237"	10.79
6⅝	.134"	9.29
	.156"	10.78
	.188"	12.89
	219"	14.97
	.250"	17.02
	.280"	18.97

ECONOMICAL WATERAIL-TRUCK DELIVERY

This Company is ideally situated on the Mississippi-Ohio River system and the great Cincinnati rail-truck hub. New large facilities, 7 major railroads and 43 motor carriers enable Acme-Newport to give economical, dependable delivery to the entire area of the Middle West and South.

Acme-Newport Steel COMPANY

NEWPORT, KENTUCKY

A SUBSIDIARY OF ACME STEEL COMPANY

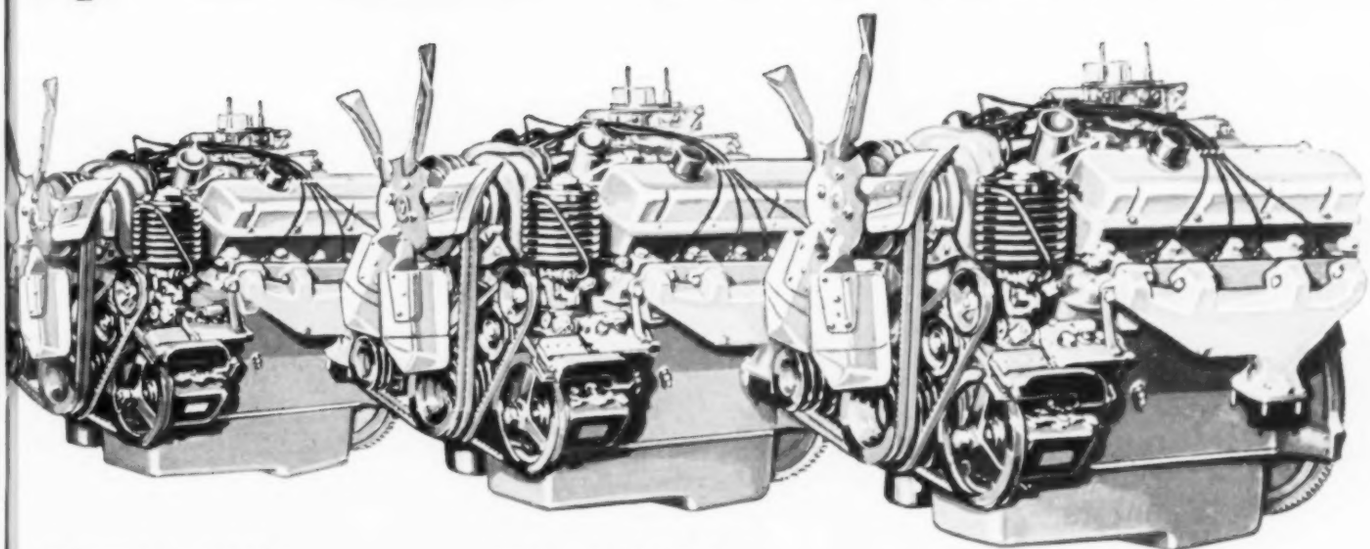
Big new FORDs

Now... up

NEW SUPER DUTY V-8 FEATURES

- Gross horsepower up to 277
- Gross torque up to 490 lbs-ft
- Modern Short Stroke design
- Three-stage cooling system
- Machined combustion chambers
- Sodium-cooled exhaust valves
- Stress-relieved blocks and heads
- Internally mounted oil cooler
- Water-jacketed intake manifold
- Submerged electric fuel pump

super duty V-8's up to 534 cu. inches!



401-cu. in. Ford V-8
Maximum horsepower—226.
Torque: 350 lbs-ft @ 1800 to 2300 rpm.

477-cu. in. Ford V-8
Maximum horsepower—260.
Torque: 430 lbs-ft @ 1800 to 2300 rpm.

534-cu. in. Ford V-8
Maximum horsepower—277.
Torque: 490 lbs-ft @ 1800 to 2300 rpm.

10 BIG NEW EXTRA-HEAVY TRUCK SERIES

GVW's up to 51,000 lb. For '58, ten new basic series are added to Ford's already extensive Heavy and Extra Heavy Duty line. Four new Tilt Cabs, four new Conventionals, and two new Tandem models offer GVW ratings up to 51,000 lb.

GCW's up to 75,000 lb. New T-950 Tandem is rated for 75,000-lb. GCW. Biggest single-rear-axle models are rated for 65,000-lb. GCW.

Front-axle capacities up to 15,000 lb. Choice of three front axles in most new Ford Extra Heavies. Rated capacities of 9,000, 11,000 and 15,000 lb.

Rear-axle capacities up to 29,000 lb. Wide choice of rear axles includes single-speed and two-speed, single reduction and double reduction types. Capacities range from 18,000 lb. to 29,000 lb.

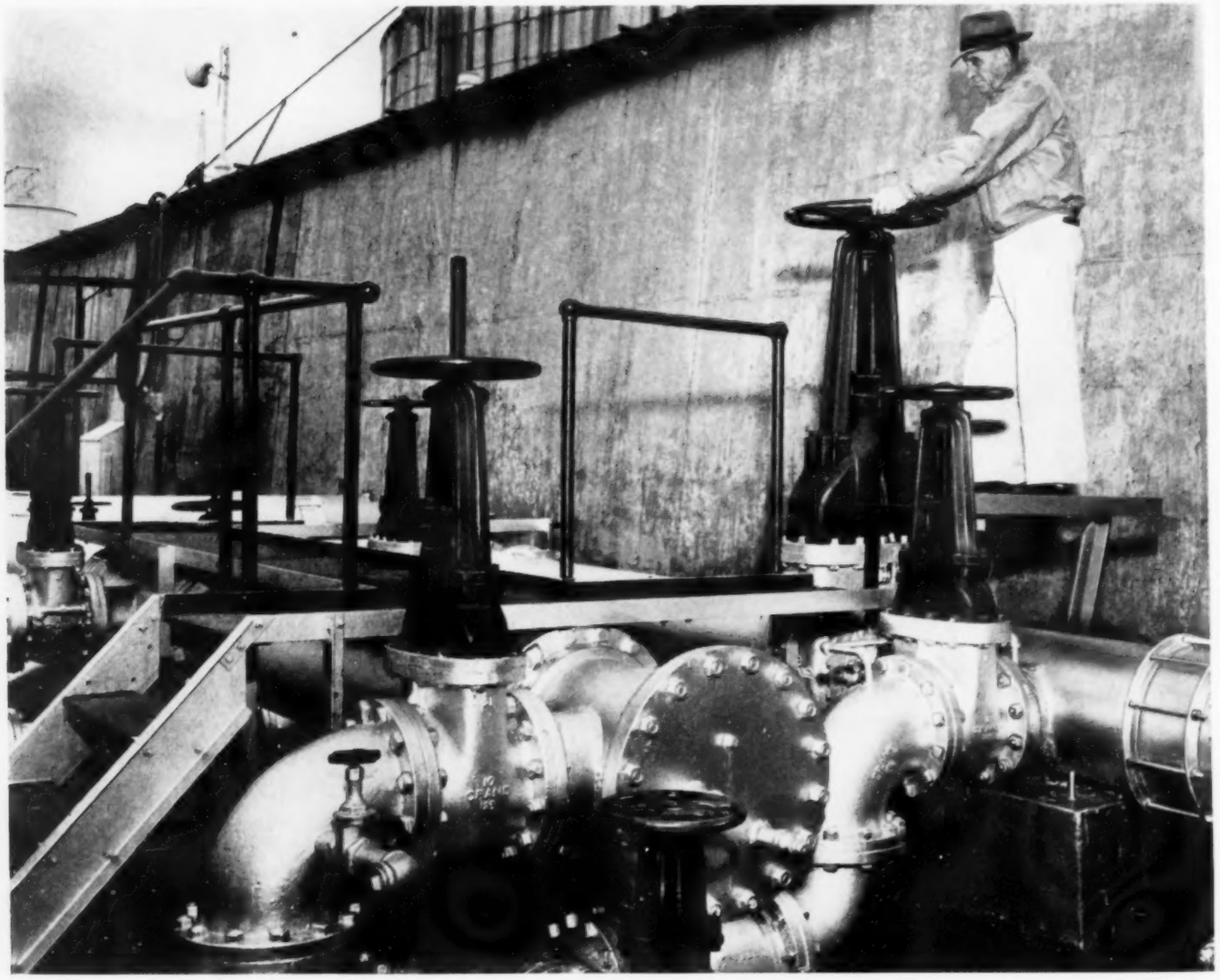
Bogie-axle capacities up to 38,000 lb. For '58 there are *five* Ford basic tandem axle models. Biggest of the *five* is the brand-new T-950 which features a tandem rear-axle assembly rated for 38,000 lb. Other bogie-axle capacities range down to 22,000 lb. for Ford Series T-700.

New transmissions. Roadranger transmission available in all ten new Ford Heavies. Up to 33% less shifting. Engines operate in peak horsepower range, use less fuel. "Short Fourth" transmissions also available on "F" and "C" Series.

FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN... LAST LONGER, TOO!

Another Performance Record for Crane Iron Body Valves



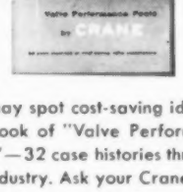
36 years in a busy marine terminal —these Crane valves never in need of repairs

Installed in 1920, the Crane iron body gate valves in this fuel oil suction manifold still have a cost-free service record. To date, not one has needed more than normal stuffing box maintenance.

The General Petroleum Corp. (owner of the installation) marine terminal in Seattle is a big, busy place—no "soft berth" for valves. The big valve, for example, is operated an average of 6 or 7 times daily. Yet, like all other valves in the manifold, it remains completely leak-free and trouble-free.

Outstanding performance? Yes, but not unusual for Crane iron body gate valves. You will find them scoring similar service records in every industry. They're strictly quality-made to give above-average performance at low ultimate cost.

Current model Crane 125-pound iron body gate valves with every desirable feature are available in patterns and sizes for all needs. Next time your Crane Representative calls, be sure to ask him about these valves. Or write to address below for complete information.



You may spot cost-saving ideas in this book of "Valve Performance Facts"—32 case histories throughout industry. Ask your Crane Representative or write for a copy.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855 — Crane Co., General Offices: Chicago 5, Ill.— Branches and Wholesalers in All Areas

been promoted to field superintendent. He was formerly superintendent of **Triangle Pipeline Company**, subsidiary of Texas Eastern.

•

Holly Bradley, safety supervisor of the **Service Pipe Line Company**, has been elected chairman of the Mid-Continent Division of the National Safety Council, petroleum section.

Holly Bradley

Bradley, who is also regional vice president of the American Society of Safety Engineers for the West Central region, will promote participation in the National Safety Council activities by the petroleum industry.

•

Harley M. McCamish has been named manager of **Mountain Fuel Supply Company's** Pipe Line division with headquarters in Rock Springs, Wyo. McCamish is former chief engineer of Sui-Karachi Gas Transmission Pipeline of Pakistan. Prior to his post with Sui-Karachi, McCamish did extensive work in designing and constructing meter and regulatory stations for industrial plants in California.

•

E. J. Boothby, president of Washington Gas Light Company, has been reelected chairman of the board of trustees of the **Institute of Gas Technology**, affiliate of Illinois Institute of Technology.

•

J. A. Vickers, president of **Vickers Petroleum Co., Inc.**, was named Oil Man of the Year in Wichita, Kansas.

He was chosen for the award by participating oil industry associations in Kansas.

•

H. W. Pope, who recently retired from **Panhandle Eastern Pipe Line Company** after 27 years of service, was honored at a reception in Kansas City, Mo. given by 50 company officials and employes.

Pope was in charge of the Land and Geological department and has assisted in the development of the company's natural gas supply.

•

Lynn D. Ervin is the new chief geophysicist with **Tennessee Gas Transmission Company** headquarters exploration staff. Ervin was with Stanolind Oil and Gas Company from 1940 to 1954. Another assignment, the appointment of **J. M. Browning** as staff geologist for overseas operation, has also been announced for the headquarters exploration staff.

•

C. R. Musgrave of Bartlesville, Okla., has retired as vice president in charge of supply and transportation for **Phillips Petroleum Company** after 35 years of service. Musgrave's background of traffic experience includes 12 years of railroading in addition to his years with Phillips since he started with the company as assistant traffic manager in 1922.

•

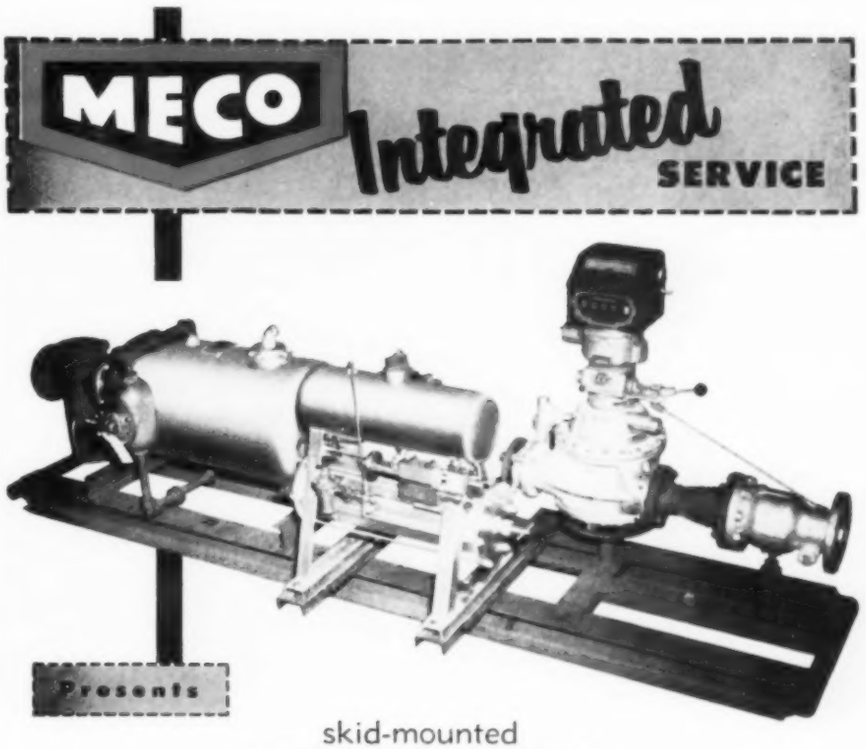
Henry H. Swigert is the new treasurer of **Cities Service Gas Company** of Oklahoma City. He succeeds **R. L. Morton** who remains vice president and director of the company. Swigert has been with Cities Service since 1930.

•

Howard C. Kauffman, Jr., has been appointed production coordinator of **International Petroleum Company Limited** at the firm's executive office in Coral Gables, Fla. Kauffman was with Carter Oil Company from 1946 until his new assignment.

Aaron Griffin

Aaron Griffin has been appointed assistant superintendent of dispatching for **Texas Gas Transmission Corporation** of Owensboro, Ky. Griffin has been employed in the Texas Gas Pipe Line department since 1949. Prior to his assignment as assistant superintendent of dispatching, he was assistant superintendent of the Kentucky-Indiana division of the company's Pipe Line department.



skid-mounted

AUTOMATIC CRUDE OIL METERING ASSEMBLY

. . . with proportional sampler

Unit automatically shuts down after allowable has been flowed, with volume corrected to 60°F and registered on counter and/or ticket.

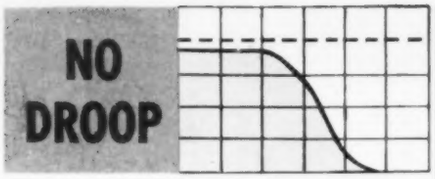
MECO sampler stores sample at line pressure.

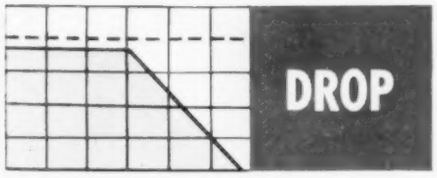
Air and non-condensible gases are automatically separated from liquid and vented. Metering of gases is prevented.

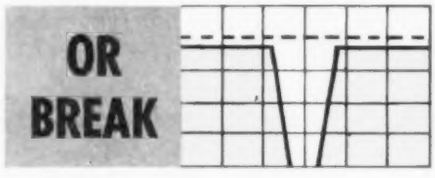
Unit includes line-size strainer • SMITH line-size deaerator • float-operated pilot and safety shut-down valve • MECO proportional sampler • A. O. Smith positive displacement liquid meter • SMITH set stop valve.

MECO
MAINTENANCE
Mechanical CORPORATION
SUBSIDIARY OF
MAINTENANCE ENGINEERING CORPORATION
P. O. BOX 2837 — 3711 CLINTON DRIVE
PHONE CA 2-2351 — HOUSTON 20, TEXAS

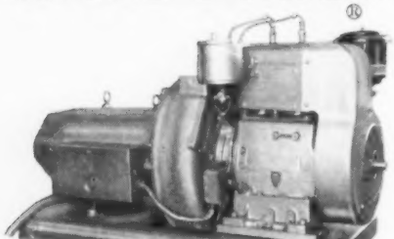
For more data on advertised products, use Readers' Service Cards, last page.







in Communications with U. S. MICRO-POWER®



Pat. No. 2688704

Your Insurance Policy for . . .

Stable Continuous Uninterrupted

Communications Power

Micro-Power operates *with* the main source of power. No time consuming "load transfers." No "power outages" *even for precious seconds!*

Micro-Power Units are available in 1500, 3000, 5000 and 10000 watt capacities. For complete information, specifications, and demonstration, write . . .

UNITED STATES MOTORS CORPORATION
LIGHT US POWER
OSHKOSH · WISCONSIN

U. S. MOTORS CORP.
102 W. 5th Avenue
OSHKOSH, WISCONSIN

WHO'S MEETING WHERE

February

American Society for Testing Materials, committee week, Hotel Statler, St. Louis, Mo., Feb. 10-14.

National Association of Corrosion Engineers, short course for pipe liners, Mayo Hotel, Tulsa, Okla., Feb. 12-14.

National Society of Professional Engineers, Spring meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.

Pipe Line Contractors Association of Canada, Fourth Annual Convention, Empress Hotel, Victoria, B. C., Feb. 20-22.

ASCE, pipe line division, Sherman Hotel, Chicago, Ill., Feb. 24-26.

Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Texas, Feb. 28.

API, division of production, southern district meeting, Shamrock Hilton Hotel, Houston, Texas, Feb. 26-28.

March

Gas Conditioning Conference, sponsored by University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., March 5-6.

American Society of Mechanical Engineers, Gas Turbine Power Division, Shoreham Hotel, Washington, D. C., March 3-6.

Petroleum & Chemical Industries short course on gas conditioning, University of Oklahoma, Norman, Okla., March 5-6.

Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio, March 7.

NACE Annual Conference, Civic Auditorium, San Francisco, Calif., March 17-21.

New England Gas Association annual meeting, Hotel Statler, Boston, Mass., March 20-21.

American Congress on Surveying and Mapping & American Society of Photogrammetry, consecutive meetings and coexhibit, Shoreham Hotel, Washington D. C., March 23-29.

Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo., March 24-26.

Oklahoma Utilities Association, Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 27-28.

American Petroleum Institute, Annual Pipe Line Conference, Jung Hotel, New Orleans, La., March 31-April 2.

American Institute of Electrical Engineers, southwest district meeting, Mayo Hotel, Tulsa, Okla., March 31-April 2.

April

Fifth Annual Conference on Corrosion Control, sponsored by University of Oklahoma, Extension Study Center, Norman, Okla., April 1-3.

API, Division of Production, Mid-Continent District Meeting, Biltmore Hotel, Oklahoma City, April 9-11.

Thirty-fourth Annual Gas Measurement, short course, sponsored by University of Oklahoma, North Campus, Norman, Okla., April 15-17.

Natural Gasoline Association of America, annual convention, Baker & Adolphus Hotels, Dallas, Texas, April 16-18.

American Institute of Mining, Metallurgical, & Petroleum Engineers, Louisiana-Arkansas, East Texas, & Mississippi petroleum sections, gas technology symposium, Shreveport, La., April 17-18.

API, Division of Production, Rocky Mountain District Meeting, Cosmopolitan Hotel, Denver, April 21-23.

Independent Petroleum Association of America, midyear meeting, Hotel Sherman, Chicago, Ill., April 27-29.

Third Annual Conference on Automatic Control in the petroleum & chemical industries, sponsored by University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., April 28-29.

Southern Gas Association Annual Convention, Dallas, Hotel, April 28-30.

Automatic control in petroleum and chemical industries, annual conference, University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla., April 28-29.

PIEA & PESA joint convention, Adolphus Hotel, Dallas, Texas, April 29-May 1.

May

American Gas Association, distribution, production and transmission conference, Roosevelt and Commodore Hotels, New York, May 5-9.

API, Division of Production, Eastern District Meeting, Deshler-Hilton Hotel, Columbus, Ohio, May 7-9.

American Society of Mechanical Engineers, Oil & Gas Power Division 30th annual conference and exhibit, Philadelphia, Pa., May 12-15.

Second Annual Stationary Industrial Engines, course sponsored by University of Oklahoma, at Norman, Okla., May 13-14.

API, Division of Production, Pacific Coast District Meeting, Biltmore Hotel, Los Angeles, May 22-23.

Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa., May 20-22.

June

API, division of transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va., June 8-11.

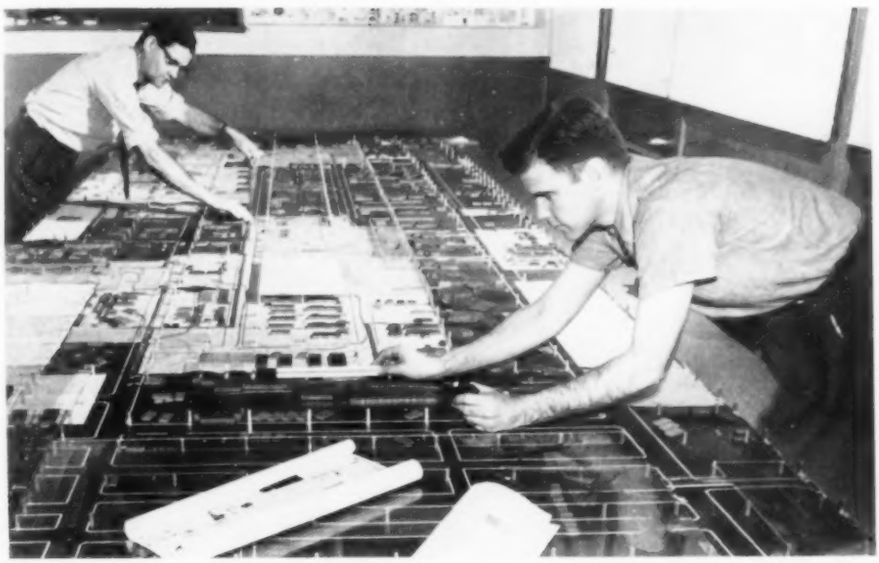
Michigan Gas Association, Grand Hotel, Mackinac Island, Mich., June 21-22.

American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, Boston, Mass., June 22-28.

Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City, Utah, June 23-25.

Canadian Gas Association, annual meeting, Manoir Richelieu Hotel, Murray Bay, Quebec, June 24-27.

What's Happening among SERVICE and SUPPLY MEN



National Cylinder Gas Expansion

Planning engineers measure plant dimensions shuffling quarter-inch scale models and plot new production flow lines in anticipation of plant expansion for Tube Turns division of National Cylinder Gas Co. A $400,000 conversion of buildings on its property adjacent to the main office marks Tube Turns' largest physical growth since moving to Louisville, Ky., in 1936.

Bucyrus-Erie Names E. T. Goree Assistant General Sales Head

Edwin T. Goree has been promoted to assistant general sales manager of Bucyrus-Erie Company and will assist L. E. MacDonald, general sales manager. Before joining Bucyrus-Erie, Goree was manager of Pacific Steel and Copper in San Francisco. He started working for Bucyrus-Erie in 1947 in the Export Sales department and traveled in Mexico, Central America and South America for the company. He was field representative for Mexico in 1951 and assistant sales manager at the firm's South Milwaukee office in 1955.

E. T. Goree

Two Officials Promoted By Youngstown Sheet & Tube

The Youngstown Sheet and Tube Company has promoted Ed O. Reese to manager of the Youngstown district and John H. Stone to general superintendent of flat rolled and tubular products.

Reese was formerly general superintendent of flat rolled and tubular products, and Stone was most recently assistant superintendent of the seamless tube mill finishing department. Reese succeeds J. S. Stanier who retired recently. Reese joined Youngstown in 1935.

Stone, former Carnegie-Illinois Steel Corporation personnel assistant and junior industrial engineer, joined Youngstown in 1947.

Homelite Appoints Thompson Executive Vice President

Nelson Thompson has assumed the newly created position of executive vice president of Homelite, a division of Textron Incorporated of Port Chester, N. Y.

Nelson Thompson

Thompson has been vice president of sales since 1941. He joined the company in 1929 as a salesman and later organized the Detroit sales area.

G. H. Blackburn Appointed New W-K-M Foundry Manager

Glenlyn H. Blackburn has been appointed foundry manager for W-K-M, Division of ACF Industries, Inc.

Blackburn will be responsible for all operations at the new foundry. He came to W-K-M after 22 years with Walworth Company of Greensburg, Penn., where he was superintendent of foundries for the past five years.

Curtiss-Wright Corp. Selects Clark General Sales Manager

Harold C. Clark is the new general sales manager of diesel equipment for Curtiss-Wright Corporation's Utica-Bend subsidiary. He will direct the sales of the Mercedes-Benz diesel engine line, recently acquired by Curtiss-Wright.

H. C. Clark

Clark was formrely with the Findlay division of Gar Wood Industries where he held the position of sales manager. He was previously associated with Buffalo-Springfield Roller Company and Cleaver Brooks Company.

Francis E. Brylski is the new assistant to the general sales manager at the Utica-Bend subsidiary. He was previously associated with the Findlay division of Gar Wood Industries.

Pat Henry New Sales Head For Schramm, Incorporated

Pat Henry is the new sales promotion manager for Schramm, Inc., manufacturer of industrial compressed air equipment. Henry replaces George B. Comfort who has been assigned to a special project for the firm.

Henry was previously sales promotion manager of Willson Products division at Ray-O-Vac Company of Reading, Penn.

Walker New Sales Manager Of Hammond Iron Works

Max W. Walker has been appointed sales manager of the Pittsburgh office of Hammond Iron Works.

Walker was formerly southeastern sales manager of the company with headquarters in Birmingham, Ala. Prior to joining Hammond, Walker spent six years as Chicago district sales manager for Murphy Diesel Company of Milwaukee, Wis.

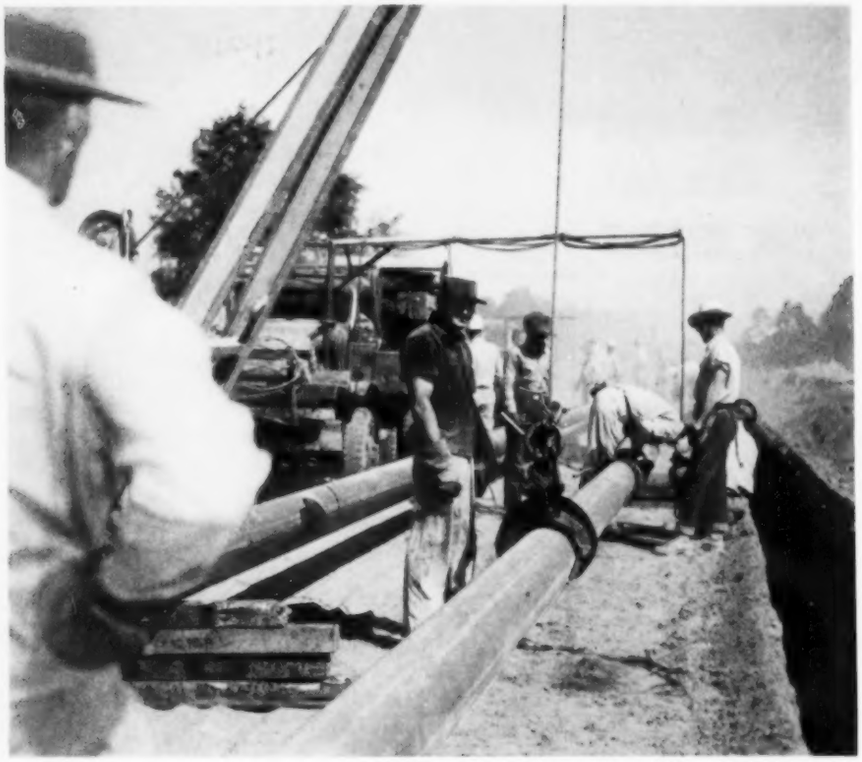
Jones & Laughlin Opens New Oil Field Supply Store

Opening of a new oil field supply store in the Panhandle district was announced by Jones & Laughlin Supply Division at Tulsa. H. U. Everett, district sales manager, is the over-all superintendent of the supply store, located in Liberal, Kansas.

Fyr-Fyter Co. Board Elects Four Senior Vice Presidents

Four senior vice presidents of the Fyr-Fyter Company of Dayton, Ohio have been elected by the firm's board of directors.

The men are David McGilvrary, senior vice president in charge of administration for the parent company's seven divisions; A. C. Trautwein, senior vice president in



you can depend on Lone Star API pipe

...quality controlled for long, trouble-free service

Crossing rivers, bending over steep hills and rugged terrain is routine for Lone Star electric weld line pipe. Joe Roughneck, heart of the oil and gas industry, knows he can depend on Lone Star API casing, tubing and line pipe . . from the oil country's own steel plant. Fully normalized, of course.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

Lone Star STEEL COMPANY

EXECUTIVE SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas

DISTRICT SALES OFFICES
Houston, Texas | Midland, Texas | Dallas, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

charge of marketing for all divisions; Charles H. Somers, senior vice president in charge of manufacturing for all divisions, and James J. Dunleavy, senior vice president in charge of Newark operations.

A. H. Clarke

R. P. Northup

Clarke, Northup Elevated At Crouse-Hinds Company

Two veteran executives of Crouse-Hinds Company of Syracuse, N. Y., have been promoted.

Albert H. Clarke, former vice president for engineering, has been named vice president for manufacturing. Clarke joined Crouse-Hinds in 1925.

Russell P. Northup, formerly commercial vice president for Condulet Sales, is Clarke's successor as vice president for engineering. Northup has been with the firm's Sales division for 22 years.

Other appointments affect John B. Crosby who will replace Northup and William A. McAuley who will become new products manager in the Sales division.

McBrien Named Vice President Of Sales for F. H. Maloney Co.

James H. McBrien is the new vice president of the Sales department for F. H. Maloney Company. McBrien vacates the position of general sales manager which he held since joining the company last June. Prior to his association with Maloney Company, McBrien had been active in sales and service engineering on pipe line and refinery construction and maintenance in U. S. and Canada.

James H. McBrien

Crose Manufacturing Co. Moves Eastern Office to Elizabeth

M. J. Crose Manufacturing Company's Eastern division has expanded into larger quarters at Elizabeth, N. J. Crose's office and warehouse was moved from Newark to the new $60,000 building. The new facility will serve Eastern Seaboard with Crose pipe line construction equipment.

James A. Maggetti Promoted To Assistant Manager Post

James A. Maggetti has been named assistant plant manager of Kaiser Steel Corporation's Napa, Calif., plant. Maggetti

in charge of sales, production and administrative functions concerning operation of the plant. Maggetti has been with Kaiser Steel since 1955 when he was made manager of the Planning and Estimating department at Napa. He previously had been with Basalt Rock Company.

Bruce McCauley

Edwin A. Link

Shand and Jurs Elects McCauley and Link to Board

Shand and Jurs Company announces the election of Edwin A. Link and Bruce McCauley to the board of directors. Link was recently appointed vice chairman of the board of General Precision Equipment Corporation, of which Shand and Jurs is a subsidiary. He is also the founder and chairman of the board of Link Aviation, Inc. McCauley came to Shand and Jurs in 1956 as vice president of finance. He now heads the Accounting, Purchasing, Industrial Relations, Office Services and Cost departments.

Dennis L. Gallogly

W. W. Waligore

New Appointments Announced By Cooper-Bessemer Corporation

Cooper-Bessemer Corporation announces three appointments in administrative positions. Woodrow W. Waligore has been named sales engineer of the Odessa branch office and George W. Edick is the new sales manager for Domestic division. Dennis L. Gallogly was elevated to assistant executive engineer.

Prior to his appointment Waligore had been associated with Humble Oil & Refining Co. for ten years. He will work among operators on engineering and application of reciprocating and centrifugal compressors for gas transmission and processing. Edick was formerly manager of the New York branch office.

The post of chief engineer, vacated by Gallogly, is managed by R. F. Kymer. Gallogly joined the company in 1929, and Kymer has been with Cooper-Bessemer since 1936.

Robert E. Palmer Appointed Williams Bros. Board Member

Robert E. Palmer, partner in the Reynolds & Company, Inc., firm has been elected to the board of directors of Williams Brothers Company pipe line constructors.

Atlas Metal Corporation Formed by Atlas Pipe, Inc.

Atlas Pipe, Inc., of Houston recently formed a new subsidiary corporation, Atlas Metal Production, Inc. The new company specializes in corrosion prevention and control services for petroleum and chemical industries. Oscar Hunter, former president of Corrosion Control Company, was appointed general manager of the company.

W. H. Becker was named president. Alvin Zwerneman, executive vice president and Richard Chacon, vice president.

Bixby Named Assistant Manager Of Standard Products Division

De Laval Steam Turbine Company announces the appointment of Donald T. Bixby as assistant manager of its Standard Products Division.

Donald T. Bixby

Bixby moves up from sales manager of the division. He has been with the De Laval Company since 1945. In 1953 he was named sales manager of Seattle District and in 1955 became Trenton sales manager.

No CONTAMINANTS in this

GAS TRANSMISSION LINE

The development of the Aerotec Dry Gas Scrubber several years ago provided the First Scrubber to assure clean gas with no carry-over of liquids or solids.

Multiple small-diameter cyclone tubes create a high centrifugal force, resulting in the removal of solids and liquids without the use of wetting agents. The result is a dry, clean product.

This principle assures high efficiency, and continuous discharge of contaminants with no pressure build-up.

Since the installation of the first Aerotec Scrubber, a continuous program of research and development has produced several new and outstanding design and applications of this principle. Our Project Engineers, with years of experience in this field, will be glad to help you in working out your problems. Why not contact them today?

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 164 Metcalfe Ave., Westmount, Montreal 6, Que.

Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

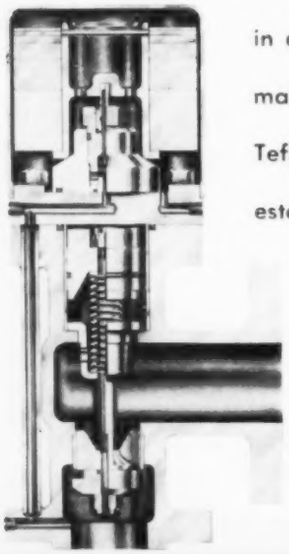
For more data on advertised products, use Readers' Service Cards, last page.

The New Model 412 Kinzbach Pressure Relief Valve

The new, improved Kinzbach Model 412 relief valve for pipelines and refineries, has a ball seated pilot valve, usually dead weight loaded, but optionally spring loaded.

Eleven advantages are included in the design and operation of this new model:

1. Positive action—line pressure is utilized for opening and closing.
2. Dependable. Opening pressure is pre-set by application of dead weight or spring load.
3. Instantaneous opening to full capacity.
4. Automatic reseating.
5. No chatter or wire-drawing at seat.
6. Functional Testing. Hand lifting of pilot stem operates valve at any pressure.
7. Simple and rugged. Valve contains only two moving assemblies.



8. High capacity. Ample flow area provided in all sizes.
9. Positive Seating. Line pressure utilized to maintain valve shut.
10. Corrosion resistant. Full stainless trim with Teflon disk.
11. No pressure accumulation needed. Full lift established immediately.

Model 412 Valve sizes are 2", 3", 4", 6" and 8" with working pressures up to 1000 p.s.i.; pilots are available in four ratios: 5:1, 10:1, 25:1, and 50:1. For complete details on this and other Kinzbach pressure relief valves, write for new catalog.

KINZBACH TOOL CO INC

Export Office:
74 Trinity Pl. New York, N. Y.

KINZBACH TOOL CO., INC., P. O. BOX 277, HOUSTON, TEXAS

Black, Sivalls & Bryson, Inc. Names New Engineering Manager

E. L. McCarthy has been promoted to manager of oil field engineering for Black, Sivalls & Bryson, Inc. He has been moved up from the assistant manager position, which he held from 1955. McCarthy will administer the company's program for oil field production and gas processing equipment, including research and development.

E. L. McCarthy

In his new post McCarthy succeeds Lawton L. Laurence, recently elected engineering vice president. McCarthy has been with the company since 1949.

Victor Valaska Transferred As W-K-M Foundry Superintendent

Victor Valaska is the new foundry superintendent for Houston's W-K-M, Division of ACF Industries, Inc. Valaska was transferred from the iron foundry in Detroit where he held the same position for four years. As superintendent he will be responsible for all production operations at the foundry.

Jones & Laughlin Appoints Hilborn as Division Controller

Ralph D. Hilborn has been appointed to the newly created post of division controller for the Jones & Laughlin Supply Division with headquarters at Tulsa. Hilborn formerly was chief accountant for Supply division, a post he was promoted to in 1953. He has been with the company since 1938, when he started as an assistant auditor in Pittsburgh office. He became auditor in the Supply division at Tulsa in 1941.

Ralph D. Hilborn

Cathodic Protection Service Establishes New Coating Division

John C. McIntosh has joined Cathodic Protection Service as sales manager of its newly formed Protective Coating division. McIntosh has had experience with Polyken tape coating in the Sales and Service department. He will head the company's development program in protective coatings and distributing Polyken tapes.

Worthington Corporation Announces Two Promotions

Worthington Corporation announces the appointment of George Steven as assistant general manager of its Compressor and Engine division. Steven had been manager of engineering and is succeeded by Harold W. Whiting. Steven has been with Worthington for 31 years, and Whiting joined the company in 1939. Whiting had been assistant to Steven since 1952.

What's New in EQUIPMENT

Mobile Electrall

International Harvester Company announces its Electrall mobile power station is available for use with any 25 horsepower or larger tractor.

Principally used as a standby electrical power unit for emergency on constuction work when power lines fail, it is also practical as a fast-hitch or trailing model for tractors. Electrall will supply power for jobs when regular power is not available.

Useful as a source of current for welders, motors, drills and lights for emergency repairs, Electrall produces the same alternating current as obtained from regular high lines.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

Combination Welder

Miller Electric Manufacturing Co., Inc., announces a combination a-c/d-c welder for inert gas and metallic arc processes.

Some of the basic features of Miller Gold Star 300 are magnetic amplifier circuit, arc starting control, sealed semi-metallic rectifiers and flick switch change-over from a-c to d-c, straight or reverse polarity.

Electrical control circuit permits addition of a wide choice of timers and remote controls for manual and automatic metallic and inert gas operations.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

Cylinder Attachment

A hydraulic cylinder attachment for tilting Cat No. 7s bulldozers has been announced by Caterpillar Tractor Company.

Replacing the bulldozer blade's left tilt brace the cylinder provides in-the-seat blade tilting. A front mounted single valve hydraulic control operates the cylinder and is available separately. Hydraulic cylinder enables the blade to be tilted to either side making the attachment more versatile.

(This item supplements Caterpillar Tractor data on Pages 67-69 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

Solenoid Valve

Skinner Electric Valve Division announces a solenoid valve that permits flow of water, air, oil and other common media.

Only a small area of the diaphragm is exposed to pressure thus allowing a long, trouble-free life. The soft, synthetic insert is also shockproof and provides tight operation.

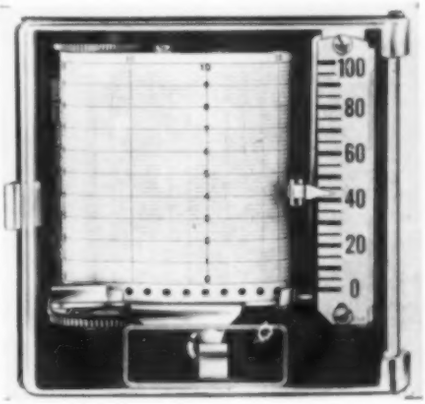
For more data, circle **No. E4** on Readers' Service Card, last page this issue.

New Engines

Wisconsin Motor Corporation announces a new four-cylinder engine which stepped up the company's horsepower range to a new high of 56 hp. Model VR4D is the newest production of Wisconsin Motor.

A single cylinder, four-cycle, engine has also been announced by Wisconsin. This engine is the AGN, 12½ hp at 3200 rpm.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.



Pressure Gage

A recording pressure gage which uses a three-inch strip chart has been announced by The Bristol Company.

Several versions are available. One records and indicates pressure measurement, another records and indicates one pressure and records the second, while a third records and indicates one and indicates the second. Models come with either pneumatic or electric chart drives, in a variety of chart speeds.

Gages range from 0-3 pounds per square inch to 0-60 psi.

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

130,000 lb.
Model PBI-24BH Sideboom for TD-24 Tractor. Increased Lifting Capacity—130,000 lb. using maximum cwt.
72,500 lb.
Model SBI-182BH Sideboom for TD-18 Tractor. Increased Lifting Capacity—72,500 lb.

FIVE outstanding p

that give you greatest pipe-handling c

These five International Superior sidebooms with increased lifting capacity give you the greatest pipe-handling ability for your equipment dollar in their respective classes. There's a machine for every job, every operator—the TD-9 for utility work, the TD-14 and TD-18 for average jobs, and the instant-shifting, power-steered TD-24 for mainliners.

And look at the profit possibilities you get with exclusive International Superior features...

- International Superior booms put as much as 14% less poundage psi on tracks than other makes using same width shoes and standard counterweights. You get a mud-beating margin of flotation, and extra traction that easily handles big pipe loads on slopes and boggy ground.
- Fleeting sheaves on boom and load lines prevent cable from piling and crushing on drums, thus increasing cable life and operator safety.
- Gear-type splines drive drum clutches—no keys to break and cause delay.
- Reach-easy controls in vertical cluster (with horizontal lever travel on some models) for operator convenience and safety.

42,700 lb. •
Model SBI-182 Sideboom for **TD-18** Tractor. Increased Lifting Capacity—40,950 lb. With Blade Backfiller—42,700 lb.

35,250 lb.
Model SBI-142 Sideboom for **TD-14** Tractor. Increased Lifting Capacity—33,575 lb. With Blade Backfiller—35,250 lb.

19,500 lb.
Model SBI-91 Sideboom for **TD-9** Tractor. Increased Lifting Capacity—18,000 lb. With Blade Backfiller—19,500 lb.

g performers

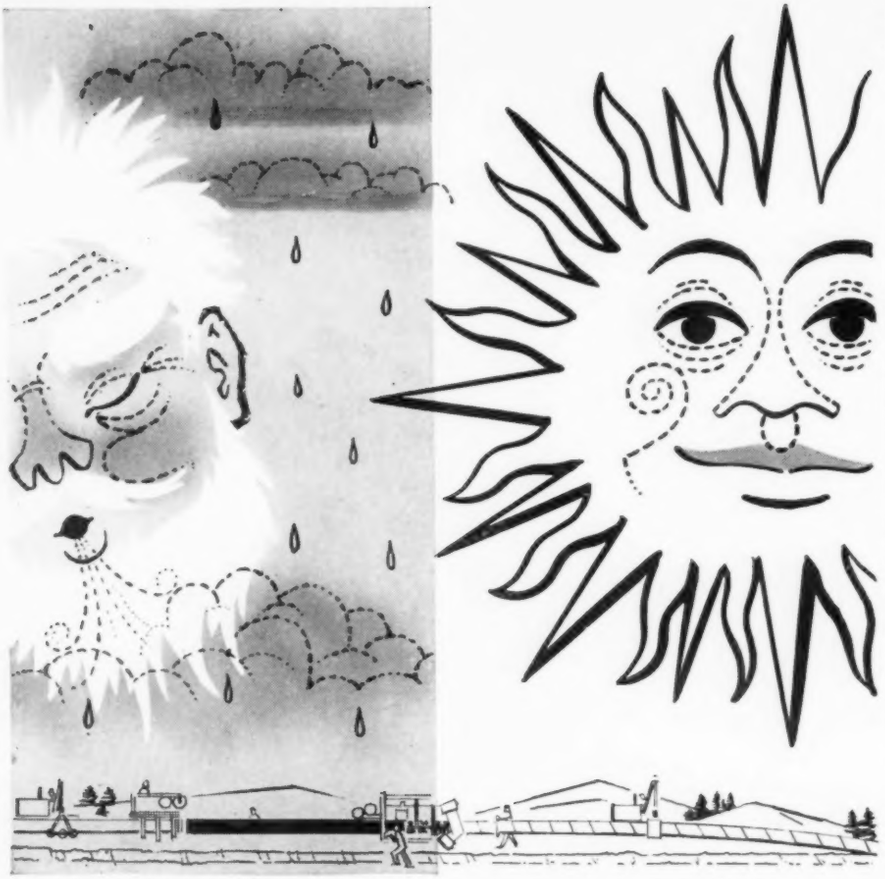
ng capacity per equipment dollar...

- Individual drum shaft mounting on TD-24, TD-18, and TD-14 keep cable properly aligned with a center boom cable pull that prevents piling.
- Remote mounting of shift lever simplifies selection of proper sideboom transmission gear.
- Box frame shield for load line protects operator.
- Non-slip, jaw-type drum clutches, with power both up and down, assure direct clutch alignment and increase operator safety.

You can see what these boom capacities and operating features mean in increased operator production and performance on your jobs. Let your International Superior distributor show you how to add to your pipelaying profits.

International Harvester Company, Chicago 1, Ill.

INTERNATIONAL®
SUPERIOR



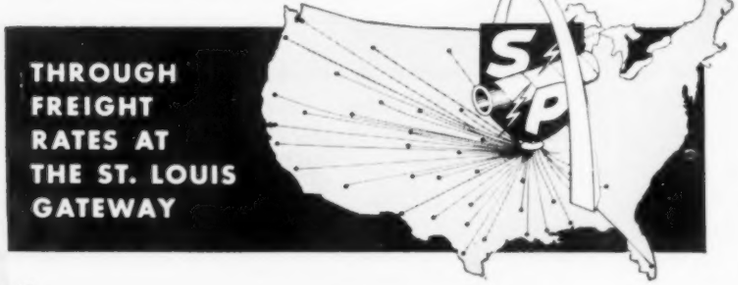
MIGHTY HOLES FROM LITTLE HOLIDAYS GROW

It goes without saying that every piece of pipe at Standard Pipeprotection is electrically holiday detected at the end of its processing. The absence of holidays indicates that the pipe, when underground, will last for many years, for the coating and wrapping has been done under ideal conditions — correct temperatures of materials and surroundings with no dirt and moisture present — and excellent bond has been achieved.

Yes, you can do it a cheaper way, but don't blame the workmen entirely for poor results. The man to blame is the Weatherman. He may blow dirt, moisture, dust, rain or snow onto the pipe under the primer or between the coatings and wrappings. When holiday detected, holidays may not show up.

The pipe goes underground. Then, the impurities go to work causing holidays, and in time, the little holidays grow into mighty holes.

Be wise, buy the finest pipe protection, buy Standard Pipeprotection.



standard pipeprotection inc.

3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MISSOURI

Drain Valves

Double seal drain valves, which eliminate the need for draining a tank or feed line to correct a valve leak, have been announced by Clary Dynamics division of Clary Corporation.

Drain valves have a secondary poppet which automatically seals the opening when primary poppet is removed to prepare a leak, thus holding the fluid in the line or tank.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

Pipe Sling

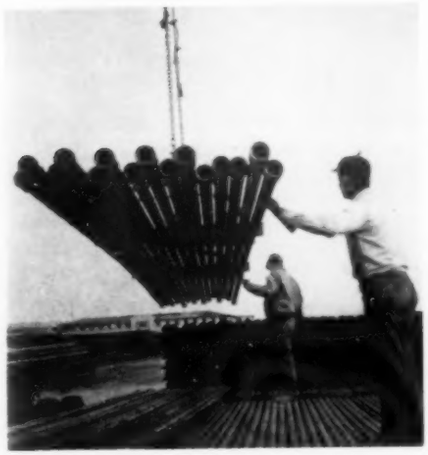
Crutcher-Rolfs-Cummings announces a strong lowering-in belt for coated pipes. The "pipe sling" consists of woven interlocking steel links for inner reinforcement and a sheath of hard rubber on the outside.

The overall thickness of 5/8 inch for each sling allows for ease in operations in tight ditches. Pipe slings come in sizes ranging from 12 inches to 36 inches. Ulti-

nate lifting capacity of the largest size is 100,000 pounds.

(This item supplements Crutcher-Rolfs-Cummings, Inc. data on Pages 107-110 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E8** on Readers' Service Card, last page this issue.



Pipe, Tube Lift

Leo Reel-Protoleft Company announces a new pipe and tube handling lift to accelerate production and reduce costs in unloading pipe.

All sizes of pipe can be accommodated with the lift which is produced in 5 to 31 joint units. Using only one man to operate the new lift and two helpers, over 1300 joints can be transferred from barge to rail car in one hour.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

Mobile Transistor

General Electric has developed a transistor-powered line of mobile radio equipment. The 60-watt unit featured above is now in production. It may be used with either positive or negative ground 12-volt d-c systems. Transistorized power supplies will be associated with both transmitter and receiver, allowing for more dependable service.

With reduction of electrical noise communication, range will be extended.

(This item supplements General Electric data on Pages 181-188 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

Station Transmitter

A high power base station transmitter, designed to give dispatchers of mobile communication systems more ability to reach distant vehicles, has been announced by General Electric.

The UHF transmitter will deliver up to 250 watts and the unit may be licensed in the 450-460 mc band. Increasing power output up to 12 decibels, the transmitter enables dispatchers to talk up to 50 percent farther. All adjustments are made independent of each other to simplify tuning. Also automatic voltage regulation assures peak efficiency regardless of line voltage.

(This item supplements General Electric data on Pages 181-188 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

REPAIR LEAKS
QUICKLY—PERMANENTLY

SKINNER-SEAL PIPE JOINT CLAMPS stop leaks at joints. Put on under pressure—without interruption of service. Quick, simple, lasting repair. Sizes 1/2" to 24" incl. in stock.

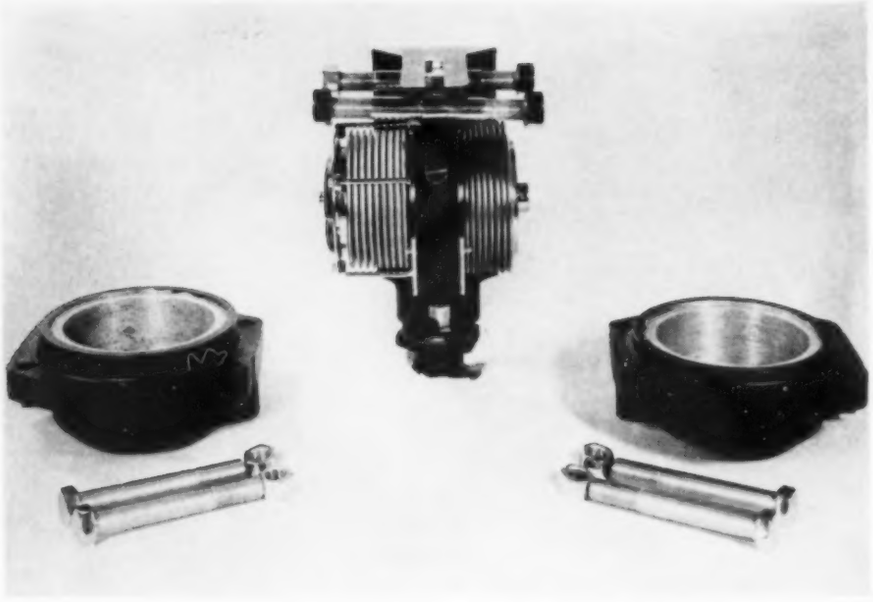
SKINNER-SEAL COLLAR LEAK CLAMP—designed to stop every type of collar leak in oil and gas lines. Sizes: 2" to 13" inclusive.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA, U. S. A.

NOTICE: Specify **PELCO** Welding Saddles

No change except the corporate name. We still have the same ownership, same management, same address, same telephone, and use the same 45 years of experience to render the same service under the same trade name—"PELCO."

PELICAN SUPPLY CO. INC.
P. O. Drawer 1108 Shreveport (84), La.
SEE YOUR NEAREST SUPPLY HOUSE



Flow Meter

A bellows-type flow meter designed primarily for the oil and chemical industries has been announced by Minneapolis-Honeywell Regulator Company.

Differential pressure measuring device maintains accuracy to within one-half of 1 percent. Flow meters are used in connection with mechanical recordings, indicating, transmission and control instruments and will be used in gas transmission pipe lines.

In operation as the differential pressure changes, liquid fill in the bellows unit from one pressure side to the other changing the range spring. This moves the bellows connecting rod, repositioning the torque tube arm which is linked to the transmitter tube.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

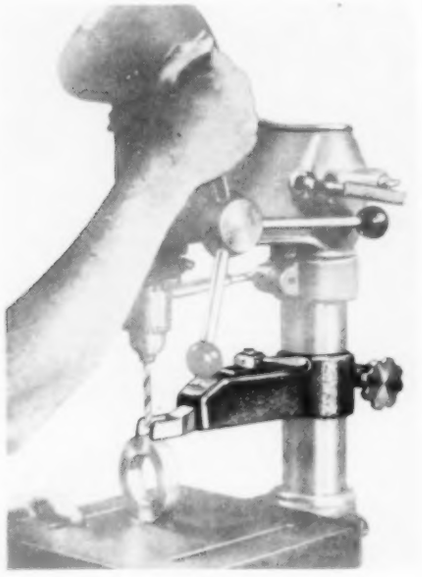
Vari-Pitch Sheave

Allis-Chalmers has announced a new 'S' section 'Vari-Pitch' sheave which permits wider changes and increased horsepower transmitting capacity. The single Groove S section has a range of 5½ inches to 120 inches, complementing the 'Q' and 'R' sections.

Also 'S' section belts from 54 to 150 inches and magic-grip bushings ranging from 2 to 24 inches are available.

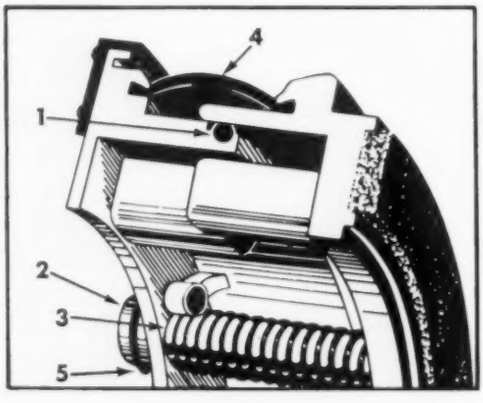
(This item supplements Allis-Chalmers data on Pages 41-44 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E13** on Readers' Service Card, last page this issue.



Sta-Put

Cincinnati Tool Company announces a 'Sta-Put' drill press collar to hold securely any shaped piece in alignment with drill.



FEATURES

1. Special "O" ring inner seal.
2. Steel locating pins.
3. Equal pressure springs.
4. Flexible bellows.
5. Rubber grommets.

Sure-Seal®

FINAL DRIVE BELLOWS SEAL

Gives Double Protection Against Lubricant Loss

The final drive on Caterpillar tractors is doubly protected against lubricant loss and damage when Sure-Seals are installed.

In addition to the conventional outer bellows seal, Sure-Seal has an exclusive "O" ring inner seal riding between two metal flanges. Keeps lubricant in, dirt, water, foreign matter out—even if bellows seal ruptures!

Other Sure-Seal features that protect you against final drive damage, repair and lost time are:

Self-aligning, equal pressure springs, heat-treated for long life. Give right amount of pressure for good seal without excess friction and wear.

Steel locating pins on seal for D-7 and D-8 are more than 1½ times as strong as cast pins. Protects against destruction of seal due to shearing of pins in freezing weather.

Flexible, oil-resistant bellows of special rubber, ribbed for extra life, wear.

Rubber grommets on locating pins make installation easier. Install Sure-Seal Final Drive Seals on your tractor for sure protection. Made for D-9, D-8, D-7, D-6, D-4.

© Copyright 1957 by

Sure-Seal Equipment Co.

1820 N.W. 25th Avenue, Portland 10, Oregon

The convenient and efficient device eliminates slipping, and reduces drill breakage and injury to hands. Sta-Put's split collar makes it easy to attach to a drill press column.

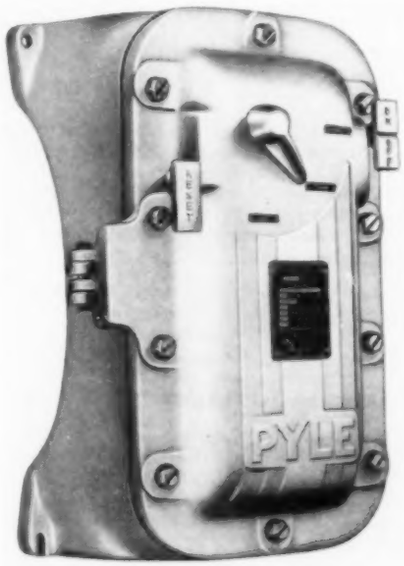
For more data, circle **No. E14** on Readers' Service Card, last page this issue.

Flexible Shaft

H&M Pipe Beveling Machine Company has announced a new flexible shaft, made to fit any size in its machine line. A length of flexible tubing, at crank handle attached to one end and the other end attached to the crack pinion on the machine, is used for the shaft. As the operator turns the crank, ring gear is put in motion, and the torch revolves around the pipe. This allows for complete visibility of the beveling or cutting operation.

(This item supplements H&M Pipe Beveling Machine Company data on Page 210 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E15** on Readers' Service Card, last page this issue.



Motor Starter

Pyle-National Company announces a weather-resistant magnetic Motor Starter Pylet. Designed to permit installation of a maximum number of starters in a given area, the motor starters are available from 1½ to 100 horsepower. A single front cover, which is hinged, is a safety feature to the starter.

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

TESTED IN OPEN COMPETITION

. . . and **ANOTHER Pipe Line Company CONVERTS TO**

John Crane®

8-B SEALS

A COMPETITIVE FIELD TEST in which one half the pumps were equipped with JOHN CRANE 8-B Seals and the other half with various competitive seals was recently conducted by a leading pipe line company.

THE RESULT showed that in *every* case the JOHN CRANE 8-B Seals out-performed all other seals in the system both in positive sealing and length of service.

PROOF AGAIN that wherever service is tough and pressures are high, 8-B Seals successfully do the job.

JOHN CRANE 8-B Seals are easily installed and will handle all pressures encountered in modern pipe lines. They are available in a full range of shaft sizes for every main line or tank farm pump service.

Request Bulletin S-215-1. Give mechanical and service details for specific recommendations.

•

Crane Packing Company, 6434 Oakton Street, Morton Grove, Illinois (Chicago Suburb)

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

John Crane

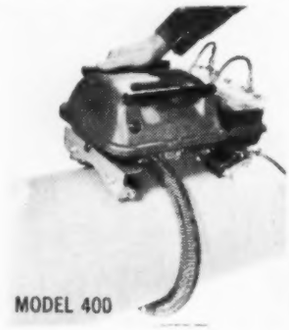
CRANE PACKING COMPANY

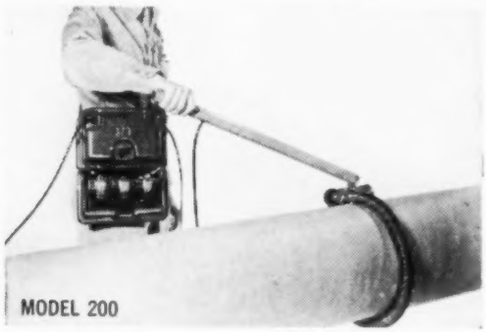
Spy Detector

QUALITY SERVICE

is there . . . when you need it!

. . . our SPY HOLIDAY DETECTORS are as near as your telephone—in fact, in emergencies our own plane assures immediate service.


MODEL 400


MODEL 200

Rugged equipment for dependable holiday detection on ¾" to 36" pipe . . . signal—bell, light and spark . . . unaffected by dew or frost.

Call, wire or write.

Pipeline Inspection Co., Inc.

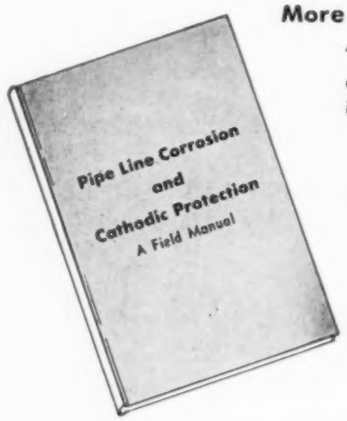
2104 WYANDOTTE STREET • KANSAS CITY, MISSOURI

Day Phone: BAltimore 1-6036

Night Phone: HI 4-6745, EM 1-3824

More comments on this new Handbook:

". . . a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."



Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

Send for your FREE copy of the New Petroleum Book Catalog which describes the nature and contents of many books pertaining to the Petroleum Industry.

ADDRESS:

Book Department
GULF PUBLISHING COMPANY
P. O. BOX 2608
HOUSTON 1, TEXAS

Fact Finder

A handy slide fact finder for pipe insulation has been announced by Union Asbestos & Rubber Company. The user is able to quickly and easily select the most economical thickness of pipe insulation. Insulation surface temperature and btu loss per lineal foot per hour readings are given for various pipes.

For more data, circle **No. E17** on Readers' Service Card, last page this issue.

Plastic Filter

An all plastic housing with a white cellulose cartridge liquid filter has been introduced by Cuno Engineering Corporation.

The cartridge is of graded density which spreads the filtration throughout the body, doubling its effectiveness. Larger particles are filtered at the surface and smaller ones at the center. This product will be applied in filtration of petroleum products and many other liquids.

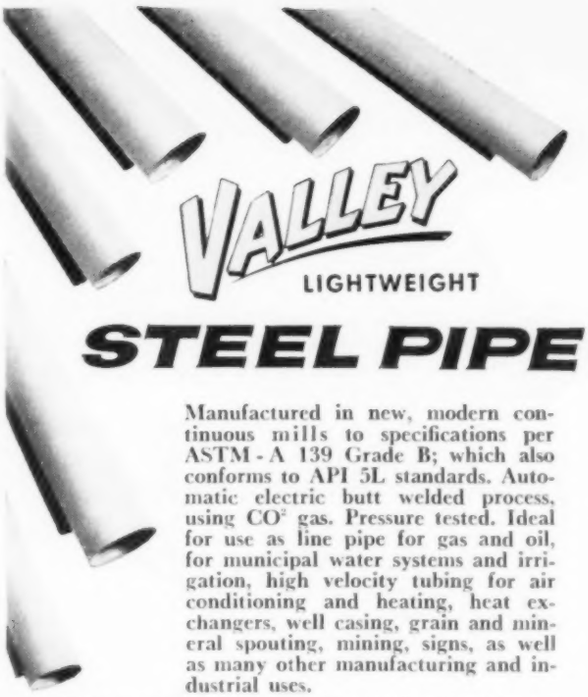
For more data, circle **No. E18** on Readers' Service Card, last page this issue.

EDITORIAL INDEX

Do you need to know when and where a certain article appeared in PIPE LINE INDUSTRY? The 1957 Editorial Index provides a time-saving entry into all 12 issues published last year.

Indexed by subject and by author, it is bound in handy pamphlet form for easy accessibility. To get your copy, write Librarian, Gulf Publishing Company, P. O. Box 2608, Houston 1, Texas. Or, if you prefer, check the square provided on the blue Reader's Service Card at the back of this and every issue of PIPE LINE INDUSTRY.

The supply is limited, so a quick order will assure you of getting a copy.



VALLEY
LIGHTWEIGHT
STEEL PIPE

Manufactured in new, modern continuous mills to specifications per ASTM - A 139 Grade B; which also conforms to API 5L standards. Automatic electric butt welded process, using CO^2 gas. Pressure tested. Ideal for use as line pipe for gas and oil, for municipal water systems and irrigation, high velocity tubing for air conditioning and heating, heat exchangers, well casing, grain and mineral spouting, mining, signs, as well as many other manufacturing and industrial uses.

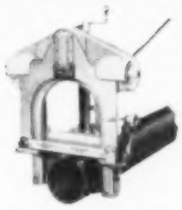
Available in 6", 6⅝", 8", 8⅝", 10", 10¾", 12", 12¾", 14", 16" diameters; from 14 gauge up to and including .219 wall thickness; 20, 30 or 40 foot lengths; in plain or belled ends. Quotations available for Victaulic or Dresser end processing, and coating and wrapping.

Available for immediate delivery.

Write or call for full specification and production data to: **Steel Pipe Division**

VALLEY **Manufacturing Company** Valley, Nebraska

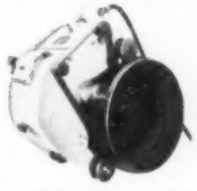
WACHS *Portable*
POWER AND MANUAL PIPE CUTTERS
2" TO 72" CAPACITY



WACHS GUILLOTINE SAW
2" to 8" Capacity
Electric or Air Drive

"BIG" GUILLOTINE SAW
10" to 16" Capacity

WACHS CHICAGO



WACHS NATIONAL SAW
"The milling machine on wheels"
Cuts 10" to 72" Pipe

WACHS STRICKLER RATCHET CUTTER
"Lathe Type Cuts"
5 sizes—2½" to 24" Capacity

Write for descriptive bulletins

THE E. H. WACHS COMPANY
Manufacturers of Engines, Valves and Machinery since 1883
1525 NORTH DAYTON STREET · CHICAGO 22, ILLINOIS

LIGHT PORTABLE TOOL BENDS 8" PIPE 90°

TAKES ONLY 3 MIN. WITH 2 HP MOTOR

ALSO USES ½ HP MOTOR OR GASOLINE MOTOR

- **EASY TO USE**—Quickly set up for pipe size and bend desired. Quick-releasing bending shoes. Bend indicator.
- **EASY TO MOVE**—Swiveling casters. Frame folds back for compact storage. Simple sections are quickly dismantled.
- **FAST and POWERFUL**—Hydraulic cylinder has 4½" bore and 60" ram travel. Pump develops up to 10,000 p.s.i.
- **SMALL and LIGHT**—By far the smallest, lightest, most economical bender available in this capacity.

SAVE UP TO 90% on piping jobs! Minimize pipe cutting and welding time . . . save cost of elbows!

You can make perfect, wrinkle-free bends . . . on the job or in the shop . . . with this low-cost hydraulic tool. Bends made cold, in just one setting. No filling.

Interchangeable parts handle ⅜" to 8" pipe, X or XX. 8" XX pipe bent 90° in only 3 min. when using 2 hp. motor. Also operates with ½ hp. motor or gasoline engine.

Write for Free Bulletin!
Learn how Tal benders can give you important savings in labor and material cost. Write today.

TAL **BENDING EQUIPMENT, Inc.**
DEPT. 34
MILWAUKEE 2, WIS.

100% Sales Acceptance on FREE Trial Offer

of the all new

Fisher

"Electronic Witch"
M-SCOPE
Pipe Finder

10 Days Free Trial

In your field, 100% of those who take the famous "Electronic Witch" on FREE TRIAL actually purchase it! Here is absolute proof of unsurpassed performance. Outperforms any pipe locator on the market regardless of price.

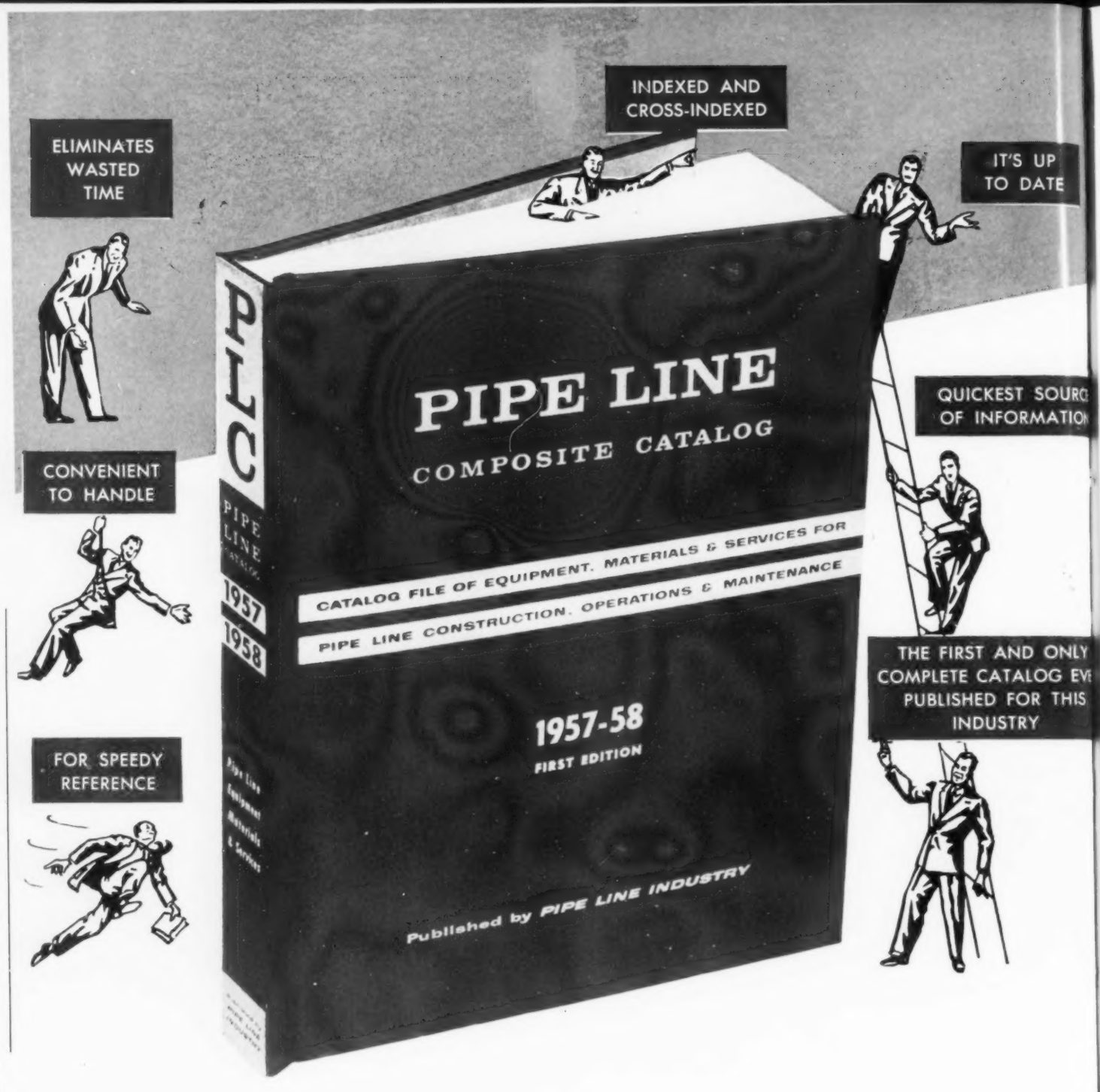
Test this new Pipe and Cable Finder under YOUR actual working conditions. State on your company purchase order that you want 10 day FREE TRIAL OFFER. Your only expense is the nominal shipping charge.

Only $189.50
with indestructible Fiberglas cabinets.

Send for FREE 1958 CATALOG
Complete Pipe Finding, Leak Detecting and Corrosion Control Equipment.

FISHER
Research Laboratory, Inc.
Dept. PI-2, Palo Alto, Calif.

Geophysical Instruments Since 1932



The first catalog data file ever published especially for the Pipe Line Business is a real success. It is serving as a genuine time saver for operating and field executives, superintendents, foremen, engineers, purchasing agents and many others who buy or specify equipment and materials.

Almost 150 leading companies have filed their complete or condensed catalogs in this useful first edition. Compiled by the manufacturers themselves, this information is arranged and indexed to offer a quick and convenient means of locating *what you want when you want it.*

If furnished to you in individual brochures, bulletins or specification sheets, the information that is now condensed into this composite catalog file would fill the equivalent of several file drawers or book shelves.

On the opposite page you'll find a complete list of the companies that have filed data in the new, specialized Pipe Line Composite Catalog. When you are looking for sales information, be sure to check these companies in your Pipe Line Composite Catalog. It is the most complete source of buying information available in one volume for this industry today.

A CF Industries, W-K-M Division
The Aerotec Corp.
M. N. Aitken Co.
Alco Products, Inc.
Aldrich Pump Co.
Allied Chemical & Dye Corp., Barrett Division
Allis-Chalmers
Alston Manufacturing Co.
American Blower Division of American-Standard
American Cyanamid Co., Jefferson Chemical Co. Subsidiary
Anchor-Wate
Automatic Power Inc.

Barber-Greene Co.
Barrett Division, Allied Chemical & Dye Corp.
J. B. Beaird Co., Inc.
Berry Hydraulics, Oliver Tyrone Corp.
Bethlehem Supply Co.
Bettis Corp.
Books for Pipe Line Industry
Borg-Warner Corp., Byron Jackson Div.
Bramble Industries, Gulf States Asphalt Co. Division
Bucyrus-Erie Co.
Buffalo-Eclipse Corp., Penberthy Manufacturing Co. Division
G. T. Bynum Co.
Byron Jackson Pumps, Inc., Subsidiary of Borg-Warner Corp.

E. L. Caldwell Co.
Philip Carey Mfg. Co.
Caterpillar Tractor Co.
Cathodic Protection Service
Central Plastics Co.
Clark Bros. Co., One of The Dresser Industries
Coffing Hoist Division, Duff-Norton Co.
Colorado Fuel and Iron Corp., Wickwire Rope Division
Commercial Iron Works
Cook Bros. Equipment Co.
C. Lee Cook Co., Division of Dover Corp.
Corrosion Rectifying Co., Inc.
G. A. Cotten Co.
M. J. Crose Manufacturing Co., Inc.
Crutcher-Rolfs-Cummings, Inc.

Darling Valve & Manufacturing Co.
John Deere—Industrial Division
Dover Corp., C. Lee Cook Co. Division
Dresser Industries, Clark Bros. Co. Division
Magnet Cove Barium Corp. Division
Drive-Thru Gate Co.
Duff-Norton Co., Coffing Hoist Division
Dutch Brand Division, Johns-Manville Corp.

Allan Edwards, Inc.
Elliott Co., Ridgway Division
Embart Manufacturing Co., The Maxim Silencer Co. Subsidiary
Engineering Research Corp.

Falk Corp.
Farrel-Birmingham Co., Inc.
Federal Telephone and Radio Co., Division of International Telephone and Telegraph Corp.
Fish Engineering Corp.
Flexitallic Gasket Co.
Fluor Products Co., Division of Fluor Corp., Ltd.

Gardner-Denver Co.
Gaso Pump & Burner Mfg. Co.
Gearench Mfg. Co.

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the first (1957) edition of the new PIPE LINE COMPOSITE CATALOG. See their detailed information in the catalog when you are ready to buy.

General Electric Co.
The Gorman-Rupp Co.
Granberg Corp.
Greenhead Sling and Supply Co.
Greenwood Valve Division, Vernon Tool Co., Ltd.
Grove Valve and Regulator Co.
The Gulf Publishing Co. (Pipe Line Forms)
Gulf States Asphalt Co., Division of Bramble Industries

H & L Tooth Co.
H & M Pipe Beveling Machine Co.
Hamer Valves Inc.
Hammond Iron Works
Haynes Manufacturing Co.
Hercules Motors Corp.
Holcombe Co., Inc.
Homelite, Division of Textron Inc.
Houston Equipment Co., Inc., Division of Houston Foundry & Machine Co.
Hudson Engineering Corp.
Humble Oil & Refining Co.
Hydril Co.

Ingersoll-Rand Co.
International Telephone and Telegraph Corp., Federal Telephone and Radio Co. Division

Jefferson Chemical Co., Subsidiary of American Cyanamid Co.
Johns-Manville Corp., Dutch Brand Div.

King Tool Co., Ltd.
Kinzbach Tool Co., Inc.

L & M Company
L-K Pump Valve Co.
Ledeen Mfg. Co.
LeRoi Division, Westinghouse Air Brake Co.
Lloyd Metal Foundry
Lubrikup Co., Inc.
Lufkin Foundry & Machine Co.

Magnet Cove Barium Corp., One of the Dresser Industries
Magnetrol Inc.
S. N. M. A. R. E. P.
Marsh Instrument Co.
Mason-Neilan Division of Worthington Corp.
C. A. Mathey Machine Works, Inc.
Mavor-Kelly Co.
Maxim Silencer Co., Subsidiary of Embart Manufacturing Co.
McFarland Engineering & Pump Co.
McFarland Manufacturing Corp.
McKissick Products Corp.
Mercoid Corp.
Midwestern Pipe Line Products Co.
Mine Safety Appliances Co.
Mixing Equipment Co., Inc.
Modern Motors Sales & Service
Morris-Young-Owens Co.
Mountain States Asphalt Co., Division of Bramble Industries

Multiple Corp.
Frank W. Murphy, Manufacturer, Inc.

National Cylinder Gas Co., Tube Turns Division
National Tank Co.
Naylor Pipe Co.
Nickles Machine Corp.

Oliver Tyrone Corp., Berry Hydraulics
Oil Well Supply Division, United States Steel Corp.

Panellit, Inc.
Peerless Manufacturing Co.
Pelican Supply Co., Inc.
Penberthy Manufacturing Co., Division of Buffalo-Eclipse Corp.
Perrault Equipment Co.
Petrolite Corp., Tretolite Co. Division
Pipe Line Development Co.
Pipelife Corp.
Pittsburgh-Des Moines Steel Co.
Plyon QX, Modern Motors Sales & Service
Porter Co.
Potter Aeronautical Corp.
Protecto Wrap Co.
Pye Telecommunications Ltd.

Quality Marsh Equipment Co., Inc.

Ramsey Winch Manufacturing Co.
Reilly Tar & Chemical Corp.
Remco Manufacturing Co.
Ridgway Division, Elliott Co.
Rochester Manufacturing Co., Inc.

Schramm, Inc.
SHMCO Valves Inc.
M. B. Skinner Co.
Snelling Manufacturing, Inc.
Southern Mill & Manufacturing Co.
Sprague Engineering Corp.
Staytite Co.
D. E. Stearns Co.
N. C. Stearns Co.
Steel Forgings, Inc.
Superior Equipment Co.

Taylor Instrument Companies
Textron Inc., Homelite Division
Thermix Corp.
Thornhill-Craver Co., Inc.
Tinker & Rasor
Tretolite Co., Division of Petrolite Corp.
John D. Trilsch Inc.
Tube Turns, Division of National Cylinder Gas Co.

United States Motors Corp.
United States Steel Corp., Oil Well Supply Division

Vernon Tool Co., Ltd., Greenwood Valve Division
J. H. H. Voss Co., Inc.

W-K-M Division of ACF Industries, Inc.
E. H. Wachs Co.
John Waldron Corp.
Waukesha Motor Co.
Westinghouse Air Brake Co., LeRoi Division
Frank Wheatley Pump & Valve Mfr.
White Diesel Engine Division, The White Motor Co.
Whitmor Homebuilders, Inc.
Wickwire Rope Division, The Colorado Fuel and Iron Corp.
Wilkinson Products Co.
Worthington Corp.
Worthington Corp., Mason-Neilan Division

Yale Machine Works

PIPE LINE COMPOSITE CATALOG

Published by PIPE LINE INDUSTRY

P. O. BOX 2608 **HOUSTON, TEXAS**

Write for Bulletin

PIPELINE VENTS AND MARKERS

FLEET-LINE CO.
P. O. BOX 276-K
SHREVEPORT
LOUISIANA

Write for Specifications Folder

FLEET-LINE®

WELDING FITTINGS

REDUCERS: Concentric and eccentric. Nominal pipe sizes 1" to 30", ASA B16.9, ASTM A234. Schedules 10 to 160, stainless steel, and other alloys. Special lengths and sizes.

SADDLES: Conventional, and for pressure vessel heads. Nozzle sizes from ¼" to 24". Fleet-Line saddles weld neatly into place in much less time, and with much less welding rod.

Complete encirclement saddles.

Fast interested service.
Write for Literature.

STEEL FORGINGS, Inc.

P. O. Box 276K • Shreveport, La.

New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Pipe Filter

Perry Equipment Corporation has issued a four-page illustrated bulletin covering gas filtering in pipe lines. Pipe scale, dust and other small particles are eliminated by this filter. Vertical and horizontal filters are available.

Perry Equipment also announces a four-page bulletin on liquid-gas separation in the line. The Filter-Sep works on the principle of a filter-trapping the liquid particles suspended in gas, filtering them from the stream.

To get a copy, circle **E19** on Readers' Service Card, last page this issue.

Compressors

A new bulletin from Cooper Bessemer Corporation of Mt. Vernon, Ohio, describes the firm's V-angle compressors Type GMXF.

The literature gives information regarding parallel turbocharging of engine-drives compressors for service from 330 to 825 brake horsepower for application on field gathering repressuring and refinery service.

To get a copy, circle **E20** on Readers' Service Card, last page this issue.

Radio Equipment

General Electric's Communication Products department has published a new brochure on two-way mobile radio equipment.

The booklet shows the wide range of equipment designed to fit individual needs based on present FCC rulings. It also tells how today's units are being engineered with future needs in mind, taking into consideration such factors as future FCC policies which may affect both public and private radio systems.

To get a copy, circle **E21** on Readers' Service Card, last page this issue.

Sheet Packings

An eight-page illustrated bulletin is available from Crane Packing Company of Morton Grove, Ill., giving detailed specifications, engineering, application and testing data on a complete line of industrial sheet packings. The 19 varieties of packings covered are fabricated from such materials as asbestos, rubber, synthetic rubber, neoprene, silicone, fiber and Du-Pont Teflon. All can be supplied in die-cut gasket form in any shape or size, standard or special.

To get a copy circle **E22** on Readers' Service Card, last page this issue.

High-Voltage Starters

The latest design features in Allis-Chalmers front access, high voltage starters, Type H, for 2300 to 5000-volt motors are given in a new bulletin released by the company.

The bulletin features the starter's roll-out type air-break contactor, Type 256-V, showing how it makes inspection and routine maintenance of the unit easy. The manner in which the starter provides protection in eight ways for men, motors and machines is diagramed in the bulletin.

To get a copy, circle **E23** on Readers' Service Card, last page this issue.

Tractor-Mounted Ripper

"Ripper Report," a new booklet recently released by Caterpillar Tractor Company, covers the wide range of uses for tractor-mounted rippers.

Illustrated and in color, the brochure pictures the four sizes of tractor-mounted rippers manufactured by Caterpillar as matched equipment for its crawler tractors. Each unit is shown at work on a job with news-type articles and photographs explaining how the machine was able to assist an owner to faster production. It includes a chart comparing the costs and production differences between blasting and ripping.

To get a copy, circle **E24** on Readers' Service Card, last page this issue.

Plug Valve Chart

A new 19 by 24-inch chart containing maintenance and lubrication information about lubricated plug valves has been issued by Rockwell Manufacturing Company.

The chart is made of heavy paper and equipped with metal edges and features detailed exploded views of four types of Rockwell-Nordstrom valves—two-bolt cover, screwed gland, three-bolt and Hypreseal. Also included is a table of recommended lubricants for oil, water, gas and chemical service as well as instructions covering valve servicing.

To get a copy, circle **E25** on Readers' Service Card, last page this issue.

Welded Steel Pipe

Armco Drainage & Metal Products, Inc., has issued a new eight-page publication on its welded steel pipe for industrial uses.

Diameters range from 6 to 36 inches; wall thicknesses 9/64 to ½ inch.

Applications covered are factory piping, process piping, water supply and sewage disposal, contractor's pipe requirements and base products. Data is included on pressure design and dimensions and properties. Other sections include welded pipe fittings for flanged pipe, joints and slip-on type flanges. Complete information is given on how to order pipe.

To get a copy, circle **E26** on Readers' Service Card, last page this issue.

APPROVED BY REFINERS

CONTAINS NO CHLORINATED SOLVENTS
OR OTHER HALIDES OR SULPHIDES

BrakeSol

The most effective chemical for treating

PARAFFIN

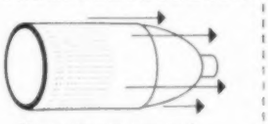
Control paraffin in tubing, flow lines and tanks by the CONSTANT injection of BRAKESOL. This eliminates costly Paraffin removal methods. Reclaim tank bottoms with BRAKESOL.

FOR SERVICE
Contact your Supply Store or nearby Treating Engineer.

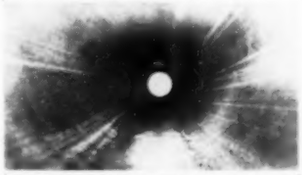
BrakeSol INC.

P. O. BOX 9506 • OKLAHOMA CITY, OKLA.
EXPORT DISTRIBUTOR: THE NATIONAL SUPPLY CO., EXPORT DIVISION

there's a better way to get it done!



Liner compresses cement mortar onto interior



Gives smooth, continuous, water proof lining of correct thickness

Tate Process applies cement mortar lining to the interior of 4" to 16" lines quickly and economically . . . while the lines stay "in place." Permanently restores full flow coefficients. Reduces pumping and maintenance costs. Protects against corrosion, contamination.

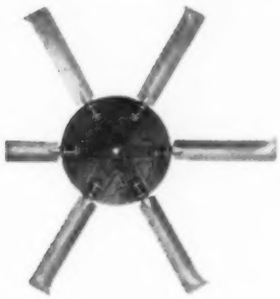
Write for full information TODAY!

Specializing in Pipe Protection Problems
• Tate and Centriline "In Place" Interior Cement Mortar Lining • "In Plant" and "Railhead" Centrifugal Spinning of Cement Mortar or Coal Tar Linings – Somastic® Exterior Coating • Pipe Wrapping • Reclamation: Removal of Old Wrapping, Straightening, Blasting, Beveling, Testing.

PIPE LININGS — A Division of American Pipe and Construction Co.
2414 East 223 St. (P.O. Box 457)
Wilmington, California

"HIGH and mighty"

move mountains - of AIR!
in towers and exchangers



- Sizes 14' to 18'
- 4 or 6 blades

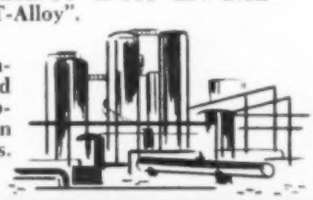
Developed originally for the petroleum industry, Aerovent Large-Diameter "Al-metal" Propellers, constructed of tough, durable aluminum alloy, move great quantities of air at high velocities, in heat exchangers and cooling towers. Pictured above are two 4-blade, 16-ft. propellers in a cooling tower installation. These mighty propellers, with adjustable-pitch "Macheta" Airfoil blades, are job-engineered to individual specifications.

Write for free Bulletin 510

DESIGNED FOR DEPENDABLE OPERATION!

Endurance tests, conducted at *3 times* normal loading prove the ability of these new large-diameter propellers to withstand severe punishment. Heavy-duty cast steel hubs offer maximum resistance to stresses. Angle settings for each operating requirement, and appropriate alternate settings, assure accurate pitch for any predetermined performance which may be required. 54" to 144" now available in revolutionary new "T-Alloy".

REFINERIES, pumping stations, industrial plants and commercial buildings use Aerovent "Al-metal" Propellers in major air-moving applications.



Aerovent FAN COMPANY, INC.
LARGE PROPELLER DIVISION
304 Wright Bldg.
TULSA 3, OKLA.
Main Office and Factory
PIQUA, OHIO

THE BERGMAN
Safty-Spanner
a helper you can trust
MADE OF THE TOUGHEST
ALUMINUM–MAGNESIUM ALLOY
WILL NOT
DAMAGE VALVES
MAKE SPARKS
MAKE BURRS
SLIP OFF
TESTED 800 LBS.
18 INCH
WEIGHS ONLY
2 LB. - 13 OZ.
Developed by the men who use them daily!
The Bergman SAFTY–SPANNER CO.
927 BUTLER ST., TOLEDO 5, OHIO

"Excellent"
WHEN YOU USE
SAND-BANUM
PURE COLLOIDAL CONCENTRATE
to Remove and Prevent
Boiler Scale and Corrosion
OUNCES ONLY
ONCE A WEEK
Stocked by Leading Supply Houses
Gulf Coast District Representatives
WESTERN SAND-BANUM CO.
1717 Chenevert Street, Houston 2, Texas
AMERICAN SAND-BANUM CO.
ESTABLISHED 1926
MEADOW BROOK NATIONAL BANK BUILDING
FREEPORT, NEW YORK
SAND BANUM

Advertisers' Index

• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 1st (1957-58) edition of The Pipe Line Composite Catalog.

A

• ACF Industries, Inc. 25
Acme-Newport Steel Co. 83
• The Aerotec Corp. 91
Aerovent Fan Company
Large Propeller Division 105c
John Allen & Sons (Oxford) Ltd. 74
• American Blower Division
American-Standard 28
American Pipe & Construction Co. 105
American Sand-Banum Co. 106b

B

The Bergman Safty-Spanner Co. 106a
Brakesol, Inc. 105a

C

• Caterpillar Tractor Co. ..... 6-7 and 68-69
The Cleveland Trencher Co. 75
• C. Lee Cook Co. 12
• G. A. Cotten Co. 106c
Crane Co. 86
Crane Packing Co. 99
Crouse-Hinds Company 81
• Crutcher-Rolgs-Cummings, Inc. 78

D

• Darling Valve & Manufacturing Co. 10
Dollinger Corp. 16

E

• Elliott Co. 14-15

F

Fisher Governor Co. 101d
Fisher Research Laboratory, Inc. 18-19
• Fleet-Line Co. 104
• Flexitallic Gasket Co. 9
Ford Motor Co. 84-85
Forge and Fittings Division
H. K. Porter Company, Inc. 70

G

• Gaso Pump & Burner Mfg. Co. 109
• Gulf Publishing Co. 100b

H

• H & L Tooth Co. 110
Houston Contracting Co. 71

I

International Harvester Co. 94-95

J

The Jaeger Machine Co. 21

K

The C. M. Kemp Mfg. Co. 10
Kerotest Manufacturing Co. 30-31
• Kinzbach Tool Co. 12

L

Lone Star Steel Co. 9

M

Maintenance Mechanical Corp. 17
F. H. Maloney Co. 8
Midwest Piping Co. 9

P

• Peerless Manufacturing Co. 2
• Pelican Supply Co. 97a
Petroleum Electric Power Assoc. 20
• Pipe Line Composite Catalog 102-103
Pipeline Inspection Co. 100a
Pipe Linings Division
American Pipe and Construction Co. 105
Pneumatic Pipelayers, Inc. 34
H. K. Porter Company, Inc.
Forge and Fittings Division 70

S

Shand & Jurs Co. 5
Shaw-Petrie Ltd. 24
• M. B. Skinner Co. 97b
A. O. Smith Corp. 22-23
Southwestern Industrial Electronics Co. 27
Standard Pipeprotection Inc. 96
• Steel Forgings, Inc. 104
Sure-Seal Equipment Co. 98

T

Tal Bending Equipment, Inc. 101b
Tennessee Gas Transmission Co. 13
• Tretolite Co. 11
Tube Turns 17

U

Union Wire Rope Corp. 26
• United States Motors Corp. 88

V

Valley Manufacturing Co. 101a

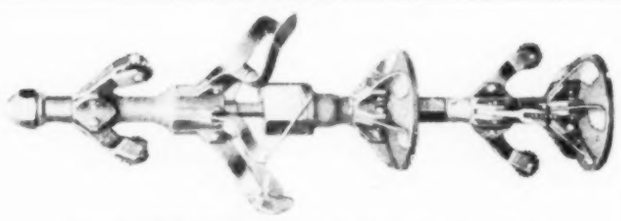
W

• W-K-M Division
ACF Industries, Inc. 25
• The E. H. Wachs Co. 101c
Walworth Company 32
Wheaton Brass Works 29

Y

The Youngstown Sheet & Tube Co. 33

Go-Devil


Standard Model Northrup Go-Devil with leather disc drivers

G. A. COTTEN CO.
Manufacturer of
NORTHRUP GO-DEVILS & TRANSIT PIPE LINE SCRAPERS
P. O. Box 5332 — Tulsa, Okla.

GASOS ARE STANDARD WITH US

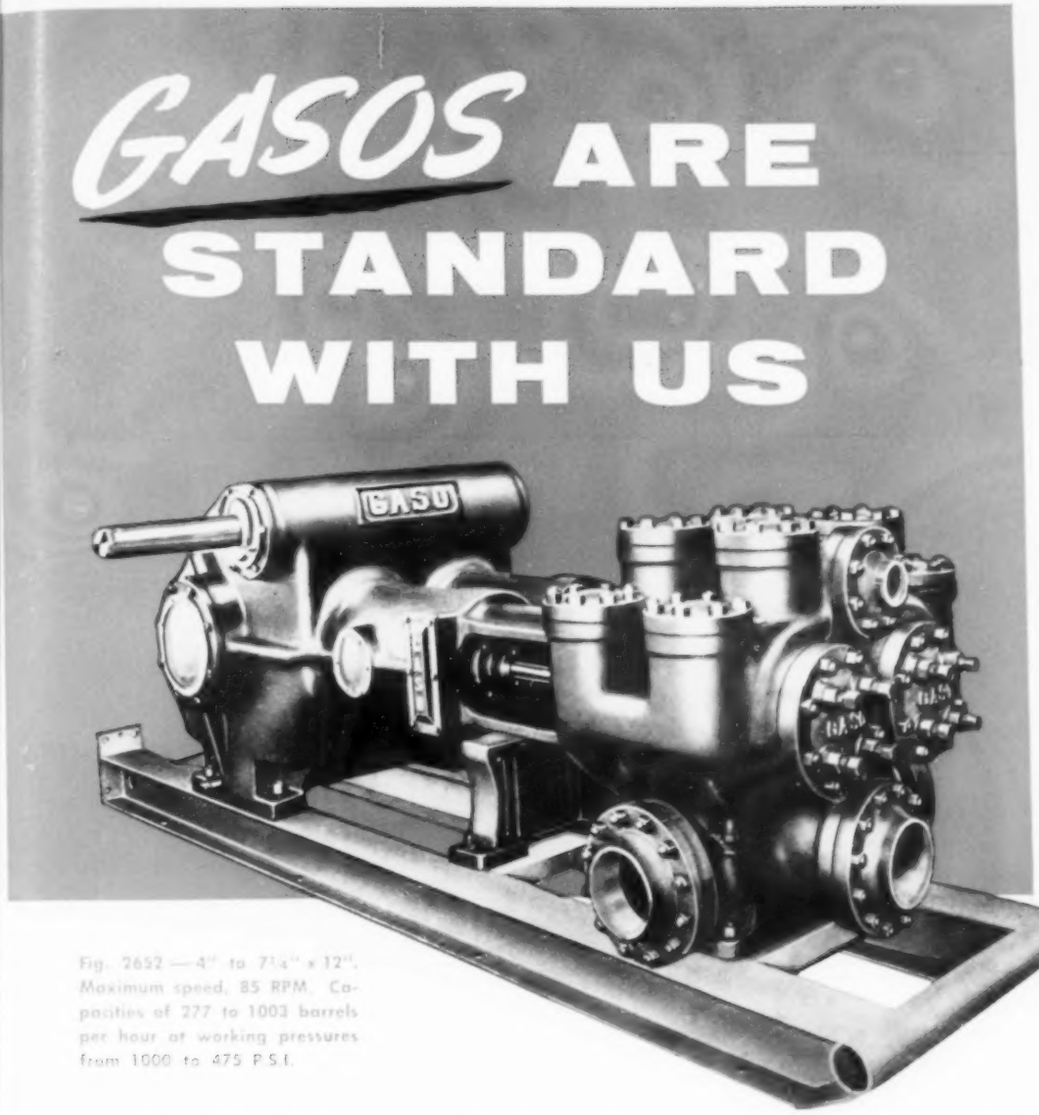


Fig. 2652 — 4" to 7¼" x 12". Maximum speed, 85 RPM. Capacities of 277 to 1003 barrels per hour at working pressures from 1000 to 475 P.S.I.

. . . BECAUSE THEY TAKE THE GUESSWORK OUT OF PUMP BUYING

As engineers, the men in my department deal in facts. They know from experience that Gaso offers models exactly suited to our various needs. They know from our service records that Gaso Pumps consistently deliver top service for unbelievably long periods, with remarkable low maintenance and upkeep costs. And they know from personal contact that they can rely on Gaso distributors for on-the-spot information, recommendations and parts service. Add up the advantages and you'll understand why we, as engineers, took the guesswork out of pump buying by making the specification of GASOS a company policy.

DISTRIBUTORS

W. L. SOMNER COMPANY, Shreveport, Louisana • Odessa, Texas • Tinsley, Mississippi • Brookhaven, Mississippi

POWER PUMPS, INC., Long Beach, California • Farmington, New Mexico

PEDDLERS, INC., Houston, Texas

PUMP ENGINEERING CO., Wichita Falls, Texas

LUFKIN FOUNDRY & MACHINE CO., Casper, Wyoming

HAGUE EQUIPMENT CO., INC., Evansville, Indiana

LUFKIN MACHINE CO. LTD., Edmonton, Alberta

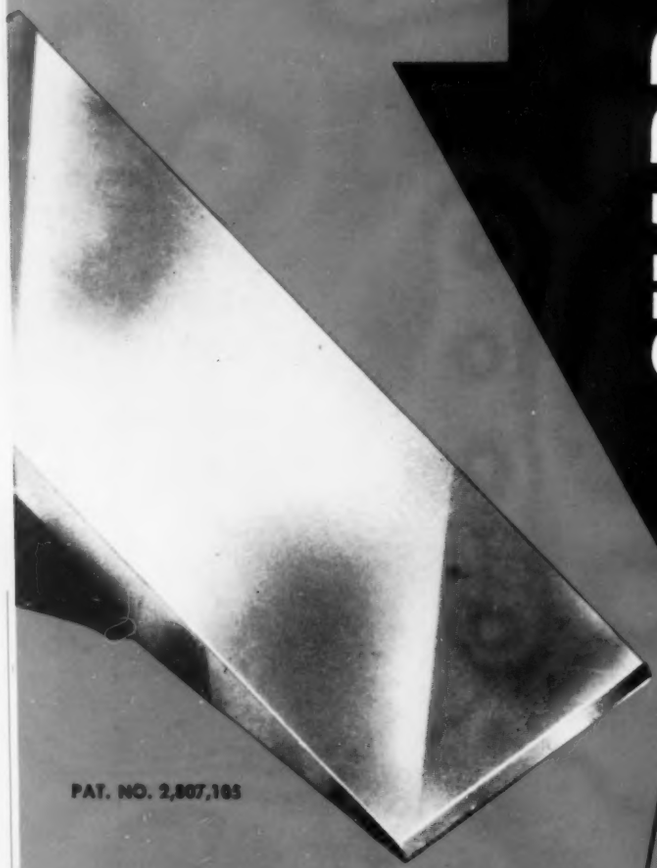
GASO PUMP & BURNER MFG. CO.

TULSA, OKLAHOMA

Export Office: 149 BROADWAY, NEW YORK

GASO PUMPS

for every oil industry need



SHARP

SHARP

SHARP

PAT. NO. 2,807,185

SHARP TEETH GIVE MORE PRODUCTION AT LESS COST, WITH LESS WEAR AND TEAR ON EQUIPMENT

teeth that really dig

H&L TOOTH COMPANY

1540 South Greenwood Avenue

Montebello, California